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CIVIL ENGINEERING.

Propelling by Steam Power on Canals. By W. Cossage.

My attention has been directed to a paragraph in the *Mining Journal* of the 21st ultimo, relating to the claims of Mr. H. Davies, of Norbury, near Newport, Salop, to the credit of being the first to apply steam power *successfully* to the traction of boats on canals, in which it is stated that "Captain Carpenter, 'long before Mr. Davies had been heard of,' introduced steam traction on the Grand Junction Canal." As I am in a condition to speak exactly to the facts of this case, I trust you will permit me to do so, and thus enable the public to judge as to whom the merit of having practically effected this important application is really due.

In the year 1841, Captain Carpenter applied to the Birmingham Disk Engine Company (of which company I was then acting as director,) to furnish the Admiralty with a disk engine of five horse power, and suitable gearing for driving a set of his patent stern propellers, to be fixed in the pinnace-boat of her majesty's frigate *Geyser*, of which vessel Captain Carpenter was then commander. Mr. Davies, being at that time the superintendent of the Birmingham Disk Engine Manufactory, prepared drawings of such gearing as he thought suitable for connecting the engine with the propellers, and these were approved of by Captain Carpenter. The whole of the work, except the propellers, was subsequently executed by the Birmingham Disk Engine Company

agreeably with these drawings, and under the superintendence of Mr. Davies. Up to this time, Captain Carpenter had not applied *any* steam engine to drive his propellers on board a boat. This boat being completed, I was present at numerous trials of her capabilities, in which we found, that, on the river Thames, where the width and depth of water are great, she accomplished a speed of nearly seven miles per hour; also, that she could tow a gun-boat conveying a large number of soldiers, at a speed of about four miles per hour. I also attended an experiment made with this boat on the Grand Junction Canal, in the presence of Sir F. B. Head, and other gentlemen interested in canal navigation, and we found that, working singly, and without cargo, she steamed a distance of about five miles on that canal, at the rate of nearly five miles per hour—and, in returning, she took in tow one loaded boat, and with this accomplished a speed of three and three-quarter miles per hour. Thus, a distance of nearly ten miles was *steamed* by Captain Carpenter's boat on the Grand Junction Canal, during one-half of which the boat was alone and without loading, and during the other half one loaded boat was towed. This is the extent of steam traction performed by Captain Carpenter on the Grand Junction Canal, and it was deemed so promising of further important results, that the directors of this canal company presented Captain Carpenter with a handsome gratuity, in acknowledgement of his exertions on behalf of canal interests. Consequent upon this experiment, the Birmingham Disk Engine Company fitted up a boat for Messrs. Pickford & Co., with a disk engine, and a set of Capt. Carpenter's stern propellers, with a view to this being employed in their carrying trade—all the arrangements adopted being approved by Capt. Carpenter. In the mean time, Mr. Davies became more fully convinced, from the above trial of Capt. Carpenter's boat on the Grand Junction Canal, of the correctness of an opinion he had entertained from the first, and which he had repeatedly expressed to myself and others, that the employment of stern propellers on canals (in which the width and depth of water are comparatively small,) was wrong in principle, and he, therefore, constructed a boat having screw propellers placed on each side of it near the bows. These two boats, viz., the one belonging to Messrs. Pickford & Co., fitted with Capt. Carpenter's propellers, and the one belonging to Mr. Davies, fitted with screw propellers placed according to his views—were each furnished with a disk engine of five horse power, and the result of numerous comparative trials made with these will be collected from the following letter addressed by R. S. Skey, Esq., the general agent of the Birmingham and Liverpool Junction Canal Company, to the *Midland Counties Herald:*—

"*Sir*,—In a recent number of your paper, in a paragraph alluding to the introduction of steam power on the Birmingham and Liverpool Canal, I observe it is stated that I, having been invited to witness the performance of a boat fitted up at the Disk Engine Works, on Captain Carpenter's principle, was so struck with the superiority of the plan, as to recommend its adoption. Now this statement is so calculated to mislead those who, like myself, may be interested in the application of steam power to canal navigation, that I must beg the favor of your

allowing me to correct it. Captain Carpenter's plan is to drive the boat by stern propellers of a peculiar form, and all experience has proved that stern propellers, in any shape, cannot be applied with advantage to the tugging of boats on canals. I feared, and Mr. Davies anticipated from the first, it would prove, what for our purpose it certainly was, a complete failure. So strong was Mr. Davies' impression that this would be the case, that he, without waiting for the result of a trial, commenced building for himself a boat to be propelled on a totally different principle. She was fitted with engines of the same power as the boat on Captain Carpenter's principle, and I tried both boats on the Birmingham and Liverpool Canal on the same day, and at the head of the same train. A very short experiment showed so evidently the inefficiency of the one, and the excellence of the other, that we resolved at once to adopt Mr. Davies' principle. Our boats, which were built from his plans, and under his inspection, have nothing in common with the one on Capt. Carpenter's plan, except that disk engines are used in both. We consider these engines to have some considerable advantages for the purpose, but, of course, the kind of engine to be employed is a mere question of cost, space occupied, and fuel consumed. I am anxious the public should know the truth; for much time, talent, and money, have been already sacrificed, as many clever and enterprising men know to their cost, in the attempt to accomplish, by the use of stern paddles, or propellers, that in which Mr. Davies has succeeded by very different means; and I should be sorry if an inaccuracy, which it is in my power to correct, should lead others into similar loss and disappointment. "ROBERT S. SKEY.

"*Canal Office, Audlem, Oct.* 10, 1843."

After the trials above referred to by Mr. Skey, the engine was taken out of Messrs. Pickford's boat, and Mr. Davies was engaged by the Birmingham and Liverpool Junction Canal Company, to carry out his views of steam propelling; and, during the year 1843, he succeeded in accomplishing a complete system of steam traction on their canal, in effecting which Mr. Davies invented and applied a new apparatus for connecting a number of boats together, so as to form a long train, capable of being steered by one man. So complete a change in this mode of conveyance excited great public attention, and some of the local newspapers having attributed to Mr. R. S. Skey, the merit of accomplishing this change, that gentleman immediately addressed a letter to the editor of the *Chester Courant*, published in that paper of the 19th of September, 1843, in which, referring to such report, he says:—"Now, this merit is not mine, and I am anxious to take the earliest opportunity of disclaiming it. The tugs were built, and others are now building, under the superintendence of Mr. Davies, the inventor of the disk engine, who had previously given proof of his fitness for the task, by constructing a boat, against which none of the ordinary objections could be raised. I am happy to give my testimony to his success, which has been so complete, as to induce us to abandon all idea of moving our trains of boats by horse power."

Amongst other parties whose attention was directed to these per-

formances, Mr. Ellis, agent to the Union Canal Company in Scotland, availed himself of an opportunity to investigate the working of this system, and Mr. Davies furnished him with the model of a boat suitable for their canal, and with details of the connecting and steering apparatus he had invented. Two towing boats were constructed according to this model, and Mr. Davies furnished the propellers which were applied to them. The performance of these boats was highly satisfactory, and drew forth commendatory notices in the *Glasgow Citizen*, and other local newspapers; but, as the merit of the arrangement was attributed incorrectly to some gentlemen of that neighborhood, Mr. Ellis, under the signature of "A Correspondent," addressed a letter to the editor of the *Glasgow Citizen*, (copied into the *Mining Journal* of August 31, 1844,) doing justice to Mr. Davies' claims.

Mr. H. Davies has constructed eight towing boats, fitted with disk engines, for the Birmingham and Liverpool Junction Canal Company, and these are now, and have been, for upwards of twelve months, regularly employed in carrying on an extensive traffic on a line of canals extending from Autherley, near Wolverhampton, to Ellesmere Port, on the Mersey, a distance of sixty-nine miles, in which two trains, usually consisting of six, or eight, loaded boats, are started from each terminus of the above line every day, and, by this means, a quantity of merchandize, averaging between two thousand tons, and three thousand tons per week is conveyed by the use of steam power on canals. The average weight of merchandize conveyed in each train exceeds one hundred tons, and the haulage of this for one mile is effected by the consumption of less than one-half cwt. of coal; consequently, the power of hauling one ton of goods one mile is yielded by the consumption of *less than half a pound of coal.* The engine is managed by one man; the train of boats is steered by one man; and the sole additional attendance is that of a conductor, (whose chief duty is to prevent pilferage,) except in passing locks, when extra assistance becomes necessary. An equal quantity of goods could not be moved by horse power, without the continued employment of six horses, with the requisite relays for changing these, and at least twenty-four men on board the boats.

Independently of Mr. Davies' arrangements for applying steam power to this purpose being totally different to those of Captain Carpenter, and others, I feel justified in stating that he is the first person who has applied this power to conveying goods on ordinary canals, to such an extent as can be considered *commercially useful;* for, although numerous attempts have been made to effect this object, yet, as in the instance of Captain Carpenter, these have all been abandoned before they have produced any practical result; therefore, I consider that the merit of being the first to apply this power usefully to canal navigation is due to Mr. Davies, and I feel confident that if the proprietors of this property were to avail themselves of the means thus presented to them, they would soon place their interests in a position very different to that to which the use of this power on railways is rapidly reducing it. I am induced to trouble you with this letter, to do justice to a talented and deserving individual; for, although my

pursuits are now very different to those of the period referred to, I cannot but feel interested in a matter to which I then devoted much time and attention, and am, therefore, desirous to contribute the information I possess as to the merits of this case.

Swansea, October 16, 1844. Lond. Min. Journ.

Description of the Roof of the New Houses of Parliament.—From Weale's Quarterly Papers on Engineering.

Of the superiority of iron over wood in the construction of roofs for buildings, the architects of the present day are becoming fully convinced, and the splendid example now set before them by Charles Barry, Esq., should at least induce all who have hitherto been indifferent to the advantages of this material in the essential qualifications of lightness, strength, durability, and safety, in cases of fire, to examine the subject with all the attention it deserves, and the result may be looked for in the more rapid progress of the substitution of iron for wood in constructing the principals of roofs, especially when of large span. Not to the roofs only, but to flooring joists, or girders, the metal material is happily adaptable also, wherever resistance to fire, and great strength, with small section, are primary objects in their construction. Of these valuable properties, the architect of this edifice has wisely and very fully availed himself, and he has, moreover, been, by this selection, enabled to offer facilities for carrying into complete effect the most complicated details of construction in flues, &c., required for the proposed system of ventilation for the extensive pile of building under his care.

But beyond the use of iron in forming the principals of his roofs, Mr. Barry has ventured to a further step, of which those unacquainted with the experience that he is cognizant of might not fully understand the wisdom, but which is thoroughly approved by all practical and scientific persons who have examined the subject minutely. We refer to the coverings of the roofs with cast-iron plates of a thin section, and galvanized by a process now admitted to present the best yet discovered means of protecting iron work exposed to the air and weather from their otherwise injurious effects.

Upon the many substantial advantages thus attained, we are induced to state briefly the impressions we have received from an attentive examination, we might say, most interesting study, of the roofs delineated and detailed in the eight accompanying plates. The cast-iron plates being cast of sufficient size to span the distance between each adjoining pair of principals, dispense with the necessity for any kind of boarding whatever, thus saving not only a great expense, but also diminishing the chances of damage by fire, which would, by destroying this boarding, leave the slates without sufficient support, thus making the whole roof liable to be broken in by their derangement; or, in the case of lead covering, the fire from the boarding communicated to the lead, would speedily reduce it to a liquid state, and create the most disastrous, or fatal, consequences. Again the cast-iron plates allow the formation of ornamental rolls on the

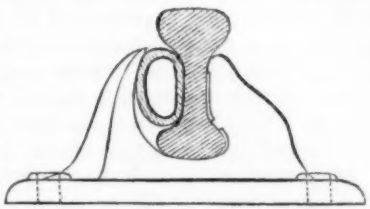
exterior, and parallel with the rafters, at the same time having vertical joints beneath these rolls, which, together with the horizontal joints, are so contrived as to be perfectly impervious to the admission of water. The architect being thus enabled to communicate an architectural character to the very roof, which cannot fail to be highly esteemed when seen in connexion with the striking features of the masonry below, when the edifice is completed. And these rolls, it must be remembered, which, in slate covering, would be impracticable, and in lead liable to considerable distortion and injury, are, when formed in iron, and cast as parts of the plates themselves, not liable to injury by any ordinary means, or circumstances, and will always retain their form, position, and imperviousness to wet and weather. To whatever purpose the spaces, or rooms, within the roofs may be applied,—and these spaces must, from the high pitch of the roofs, be very valuable for many purposes,—it is evident that uniformity of temperature will be highly desirable; and this will be attained, it is believed, to a much greater degree by an iron covering than by one of lead, slate, or any other material. The corners of each plate being firmly secured by screws and snugs to the rafters on which they lie, a greater degree of lateral strength and stiffness is attained than can be had with any other kind of covering; in fact, the whole roof, principals, and covering become one piece of framework, well knit and secured together at all points by metal connexions, so that the longitudinal tie-rods, which are introduced at the intermediate points, are very much lighter than would otherwise have been advisable, and yet are abundantly sufficient for their purpose. Much greater facilities are likewise offered by this description of covering for the attachment of ornamental dormer windows, which the architect has introduced for the purpose of lighting the rooms within the roofs, and which could not, in any other material, have been so neatly, durably, or safely, constructed and attached to the covering. In point of durability merely, if lead be allowed a comparison with iron thus prepared and adopted, the latter must be pronounced the better material. As to weight, little or no difference can be stated; and regarding their comparative expense, it is believed, allowing fairly for all circumstances, the preference must be awarded to iron. Slate, of course, cannot sustain a comparison of durability, has little advantage in lightness, and not much in point of expense. But the many valuable peculiarities belonging to iron for the purposes required, and at some of which peculiarities we have above glanced, should be held thoroughly decisive as to its employment in the erection of an edifice of which not only the architect in the present age, but the nation for many centuries, should be justified in feeling proud.

Civ. Eng. and Arch. Journ.

Railway Keys. By W. H. Barlow.

The drawing of my hollow iron keys, which is given in your last number, is calculated to produce an erroneous impression as to one of

the great advantages which they possess over modern keys. In your drawing you have shown the key as only fitting into the upper fin of the rail. In the enclosed sketch you will perceive that they fit into both the upper and lower fins, and this gives them a great advantage as joint keys, for the key being elastic the driving causes the contact with the rail to be very perfect, and the metal being hard no unevenness of the joint, or *canting* of the joint chair can take place, which is one of the great evils felt with wooden keys, for here the wood being comparatively soft and soon affected by abrasion, also the hold of the key on the rail being subject to great variation and shrinking of the wood in wet and dry weather, the joint chairs become canted, and the two ends of the rails out of level, which not only interferes with the comfort of traveling from the noise made in passing the joints, but produces unnecessary wear and tear in the engines and carriages, and increases the labor of repairing the road.



About two miles of the Midland Railway, that is four miles of single line, in the neighborhood of Rugby, which has been laid with these keys, show a remarkable difference in the steadiness of the road, and the quietness of the joints, as compared with the wood keys. It has been laid about six months, and the keys maintain their position, and hold on the rail as firmly as the first day they were put in.

The hollow iron keys require rather more care and accuracy in laying the road than the wooden keys, but in other respects they are quite as easy to use, and drive readily into their places with the common keying hammer; however, I must not say too much in favor of my own invention; several engineers are now making trial of these keys, and we shall probably in a few months learn their opinion of them.

Ibid.

Resistance of Railway Trains.

Mr. Scott Russell detailed a number of experiments on the Sheffield and Manchester Railway. For the purpose of these experiments it was necessary that the railway should present long and very steep gradients. The experiments were as follows:—1. Trains of carriages, empty, were put in motion at the summit of an inclined plane, at about 30 miles an hour, and were allowed to descend freely. 2. Trains of carriages, loaded, were tried in the same way. 3. The engine and tender were treated in the same way, being put to a velocity of between 30 and 40 miles per hour, and allowed to descend freely the whole length of the inclined plane without any train attached. 4. The engine and tender, with a train attached, were propelled to the

top of the inclined plane, and then allowed to descend freely by gravity; by these means the following results were obtained:—1. The resistance to railway carriages at slow velocities does not exceed 8 pounds per ton. 2. The resistance to a light railway train of six carriages, at 23.6 miles an hour, was 19 pounds per ton. 3. The resistance to a loaded train of six carriages, at 30 miles an hour, was 19 pounds per ton. 4. The resistance to a light train of six carriages, at 28 miles an hour, was 22 pounds per ton. 5. The resistance to a loaded train of six carriages at 36 miles an hour, was 22 pounds per ton. 6. The resistance to a six-wheeled engine and tender, at 23.6 miles an hour, was 19 pounds per ton. 7. The resistance to a six-wheeled engine and tender, at 28.3 miles an hour, was 22 pounds per ton. 8. The resistance to a train composed of six light carriages, with engine and tender, at 32 miles an hour, was 22 pounds per ton. 9. The resistance to a train composed of nine loaded carriages, with engine and tender, at 36 miles an hour, was 22 pounds. Mr. Russell observed, that the subject was of considerable importance, inasmuch as the system adopted for laying down the gradients of new lines was of necessity regulated chiefly by the opinion of the engineer on the question of resistance. How much mechanical force is required to move a given weight of train, along a given gradient, at a given speed, was a question of which the solution was essential to sound engineering, but the profession had long felt that they were not in possession of sufficient data to determine this question.—*Proc. Brit. Association.*

Lond. Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in June, 1844, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *Examiner of Patents.*

1. For improvements in the *Smut Machine, for Cleaning Grain:* Elisha W. Young, of Parkman, Ohio, and Thomas H. Wilson, of Harrisburg, Pennsylvania, June 5.

The rubbing of the grain is effected in this machine, as in many others before it, by two horizontal disks, the under one attached to a shaft, and termed the runner, has its upper face armed with concentric rings of vertical pins, and the other, called the cover, has a series of rings (corresponding in number with the rings of pins on the runner,) which project from its face and have their inner sides ribbed, and a little inclined; the middle ring of the series projects downwards more than either of the others, and serves to arrest the grain more certainly. The spaces between the rings are filled with studs, or points. The grain is fed in through an eye in the centre of the cover, and is carried by centrifugal force beyond the periphery of the runner, and descends between it and the surrounding curb, where it

is met, and acted upon, by a current of air from a fan attached to the under face of the runner; thence it runs down inclined planes, which are perforated for the admission of air to the fan on the runner, and then into inclined spouts where it is acted upon by a current of air from another fan at the lower end of the shaft. The lower gudgeon of the shaft runs in a box, or step, the bottom of which is convex, and its centre is kept on the apex of this convex surface by a metal plate which fits the box, and which is provided with a hole for the gudgeon to pass through.

Claim.—"What we claim as our invention, is the cover having a series of concentric rings projecting therefrom, with studs between them, in the manner and for the purpose set forth. We also claim, in combination therewith, the runner constructed and arranged as described. We claim also the inclined planes having their lower sides punched with holes for admitting the air to the (upper) fan, in combination with the runner, as herein specified; and in combination with the spouts for directing the blast from the lower fan, and conducting off the grain, and separating the cheat, &c. therefrom. Lastly, we claim the step constructed as described."

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2. For an improvement in the *Spring Bolt for Doors;* Albert Bingham, Boston, Massachusetts, June 5.

This spring bolt, or mortise latch, can be thrown back, or opened, by either turning the knobs, or pushing them back. The spindle of the knobs passes through a bridle, or loop, on the inner end of the bolt, and through an elongated hole, or slot, in the escutcheon plates, which are also provided with projections, or studs, ranged back of the centre, and one above the other in a vertical line; and the inner faces of the knob sockets, which are concave, have a rib, or ledge, forward of their centre, and ranging vertically. When the knobs are turned, the upper, or lower, end of these ribs, or ledges, strike against the corresponding projections, or studs, on the escutcheon plates, and cause the knobs and the spindle to slide back in the elongated holes, or slots, of the escutcheon plates, and with them carry the bolt back; or the bolt can be retracted by simply pushing back the knobs.

Claim.—"I claim the ledge, or rib, (applied and affixed to the socket, or shank, of the knobs,) in combination with one or two studs, (inserted in, and projecting from, the door, or from an escutcheon plate, affixed to the door,) and an opening, slot, or passage, cut, or formed, through the door and escutcheon plate, for the shank of the knobs to move through horizontally; the whole being constructed, arranged, and operating substantially as described, and for the purpose of retracting the spring bolt either by turning, or sliding, the knob, or knobs, in the manner set forth."

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3. For an improvement in the *Cooking Stove;* Isaac Straub, Cincinnati, Ohio, June 5.

This is for a modification of that kind of cooking stoves in which the fire chamber is placed above the oven, and consists in so arrang-

ing the flue spaces, that the draught can pass either directly out, or down the back, under, up the front, and over the top of the oven, and between it and the bottom of the fire chamber. In the back flue spaces there are two partitions, dividing that part of it which extends from the top plate of the stove to the top plate of the oven into three compartments, the two side ones being extensions of the back flue space, and the middle one the exit pipe from the flue between the oven and fire chamber, the latter being provided with a damper to permit the draught to pass directly out, or to carry it entirely around the oven.

Claim.—"What I claim is the manner of forming the space leading to the exit pipe, by means of the partition plates, for the purpose set forth, in combination with the enlarged flue space leading thereto;" (from the upper flue of the oven,) "by which arrangement, and that of the flues leading thereto, I secure an unobstructed draught into the exit pipe; and am enabled to direct the draught around the oven, in the manner herein fully made known."

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4. For an improvement in the *Cooking Stove;* Thomas Bent, Cincinnati, Ohio: assigned to W. and R. P. Resor, of the same place, June 5.

In this stove there are two ovens, one occupying the space between the back of the fire chamber and the back of the stove, and the other the entire space below these. In other double oven stoves the draught passes between the two ovens, but in this it does not, this space being converted into a heated air chamber by a close partition at the back, so that the bottom of the upper, and the top of the under, ovens are heated by the hot air between them.

Claim.—"What I claim is the manner in which the flue spaces are arranged and governed, so as to convert that part which is usually employed as a flue space between the two, into a heated air space, by means of the permanent partition; the whole arrangement of the flues, and their combination with the other parts, being such as described."

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5. For improvements in the *Process of Tanning Leather;* John Cox, of Edinburgh, Great Britain, June 5.

This is for improvements in the method long known of applying the tanning liquor to the hides, or skins, by infiltration, or percolation, and consists in applying the liquor to the skins formed into bags suspended to supply pipes from a reservoir above, and the hides separated from each other by being contained in separate compartments, or stalls, or immersed in a vat of tanning.

Claim.—"I would have it understood that I do not claim the principle of tanning hides, or skins, by causing percolation of liquor by hydrostatic pressure through their pores and fibres, nor the sewing of hides and skins into bags, nor simply filling them with liquor when unconnected with a feeding cistern, and without causing additional hydrostatic pressure; but I do claim the peculiar methods of tanning

by hydrostatic pressure, as described. First, I claim tanning hides and skins by hydrostatic pressure, when formed into bags, when they are confined, or supported, or suspended, into continuous smooth sided narrow compartments, or stalls, as described. Secondly, I claim tanning by hydrostatic pressure when a hide, or skin, is formed into a bag, and immersed totally, or partially, into liquor, and either confined in a continuous smooth sided compartment, or allowed to expand, or swell, to its natural dimensions without confinement, or jammed against other hides and skins, as described."

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6. For an improvement in *Cork Sole Boots;* William S. McCauley, Baltimore, Maryland, June 5.

Claim.—"What I claim as my invention, is the construction of the cork sole boot in the manner described, having a vand extending from the ball of the foot, where the welt terminates round the toe, which, together with the two in-soles, completely envelopes, and securely confines the cork sole, and they together form a firm basis to peg the out-sole to; the whole being constructed and arranged in the manner and for the purpose substantially as set forth."

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7. For an improvement in the *Butter Churn;* Jason B. Schermerhorn, Deerfield, Oneida county, New York, June 5.

Claim.—"I do not claim the general plan and principle of constructing churns with plungers worked either by hand, or by crank, motion, but what I do claim as my invention, and desire to secure by letters patent, is the mode of constructing dairy churns with two rake-formed plungers, with the teeth inter-raking, and with oppositely reciprocating motions, communicated to them by a cranked shaft, as set forth."

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8. For an improvement in the *Smut Machine for Cleaning Grain;* James W. Webster, Luray, Page county, Virginia, June 5.

A cylinder with oblique curved beaters works in a horizontal casing, and on the same shaft there is a fan, formed with oblique wings, to force a current of air through the meshes of a reticulated partition in the case, and between the fan and beaters the inclination of the former being the reverse of the latter, so that the current of air shall move in the reverse direction of the grain, and separate and carry off the impurities.

Claim.—"What I claim as my invention, is the combination of the cylinder of oblique curved beaters, the oblique wings, and reticulated partition, under an arrangement as aforesaid, for the purpose of cleaning grain as set forth."

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9. For an improvement in the method of *Turning Wood Tapering;* Wyllys Avery, Salisbury, New York, June 5.

We have here a modification of that mode of turning in which the wood to be turned is passed through a hollow mandrel, to which are

attached the cutters. In this machine the cutter, which gives the taper to the wood, slides in an aperture in the mandrel, and is caused to approach to, or recede from, the centre by a wedge attached to a plate, or collar, that slides on the mandrel; the said plate being embraced by a groove in an arm of a rock shaft, the end of another arm on the same shaft being caused to rise and fall by an inclined guide on the carriage that feeds the machine.

Claim.—"What I claim is the mode of moving the cutter, causing it to recede from the centre of the hollow mandrel, to cut pieces of wood tapering, by the combination of the wedge, plate, arms, and rock shaft, carriage and gauge rod, arranged and operated in the manner and for the purpose set forth, or in any other mode substantially the same, by which analogous results are produced."

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10. For a machine for making *Mercurial Ointment;* James W. W. Gordon, Baltimore, Maryland, June 5.

The material to be acted upon is placed in a vertical cylinder, in which works a series of knives that radiate from a hub attached to the lower end of a rod connected by a swivel joint to a sliding cross-head which receives its movement from a crank shaft. One side of the radial knives is flat and vertical, and the other has a double bevel, which bevel causes the whole to rotate as it moves up and down. Other knives may be attached to the radial ones, and so arranged as to project from each side, and at right angles to them.

Claim.—"What I claim as new, is the manner of forming and arranging my combined knives, each of them having a flat and a double beveled side, and being attached, in the manner set forth, to a piston rod, which is allowed to rotate; said combined knives operating in a cylinder in the manner and for the purpose set forth."

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11. For an improvement in the *Thrashing Machine for Separating Grain from Straw;* Frederick A. Stuart, Catharine, Chemung county, New York, June 5.

Claim.—"What I claim is the described mode of separating grain from straw by subjecting it to the action of an inclined revolving cylinder of teeth within a smooth case made larger at one end than at the other, for the purpose of allowing the straw and grain to have a spiral movement downwards, and around the cylinder from the feeding board, the discharging end by which it is subjected to the action of the revolving teeth at every revolution of the cylinder, without the danger of the machine clogging, and without the use of any concave of the ordinary construction provided with teeth, said concave being constructed and arranged as before described."

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12. For a machine for *Mixing Cements;* William H. Smith, Georgetown, District of Columbia, June 10.

This machine consists of a cylinder closed at both ends, except an opening at one end for feeding in the materials to be acted upon, and

another at the opposite end for discharging the cement mixed; within this cylinder there is a rotating shaft with rubbers that extend from the shaft to the inner surface of the cylinder, against which they rub.

Claim.—"What I claim is the above described machine, consisting of a metallic cylinder, metallic axle, and metallic rubbers, all as above described. The cylinder to be either stationary, or revolving, the axle to revolve within it, and the rubbers to be spirally arranged, so as to rub against the cylinder when the machine is in motion."

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13. For an improvement in the *Brick Press;* Mark Twitchell, Gray, Cumberland county, Maine, June 10.

Just under the hopper, which supplies the clay, there is a pulverizer in an inclined position, which consists of two parts, an upper and a lower, with their surfaces armed with teeth, in the form of saw teeth, and set so close together as to sift the clay as well as pulverize it by a reciprocate movement of the under one. The clay is discharged into a box which conducts it to the mould that moves back and forth with a carriage, by means of cams. The mould embraces the bed and piston, the latter sliding within it, and operated by a toggle, or elbow joint, one arm of which is in the form of a bent lever, with one of its arms connected with a crank by a connecting rod, (the other arm is termed in the claim the elbow.) The upper face of the mould has vent holes in it for the purpose of forcing back into the box the surplus clay; the bricks, after being pressed, are forced out of the mould by a small piston that moves at right angles with the main piston.

Claim.—"I claim the construction of the pulverizer, as set forth, the arrangement of the vent, to let off the surplus clay into the box, or hopper, facing the pistons with felt, gum elastic, or leather, and the combination of the small press for discharging the brick with the brick press, said small press being constructed and arranged as described. I also claim the mode of operating the press by means of the elbow and lever, operated by a connecting rod and crank, in combination with the several cams upon the wheel; said cams acting in unison with the lever and carriage—the whole being constructed and operating as set forth."

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14. For an improvement in the *Furnace for Heating Buildings;* George Walker, New Haven, Connecticut, June 10.

Above the combustion chamber there is a drum, the lower part of which is in the form of the frustrum of an inverted cone, and the upper part a semi-spheroid, and at the junction of the upper and lower parts, inside, there is a disk which acts as a deflector, there being sufficient space around it for the passage of the smoke, and other products of combustion. Back of the combustion chamber and of this drum, there are two tiers of such drums, connected together by a pipe at the bottom, and all the tiers are connected together at top by means of a pipe, provided with a damper between the first and second tiers of drums, so that the draught shall pass from the first drum through

the top pipe, down the first tier of drums, through the bottom pipe, up the second tier of drums, and through the top pipe into the chimney; the whole is to be surrounded by a hot air chamber of masonry.

Claim.—"I do not claim the parts of the above apparatus, but what I do claim as my invention, and desire to secure by letters patent, is the arrangement of the drums and combustion chamber, in the manner and for the purpose specified."

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15. For an improvement in the *Cooking Stove;* James White, Milton, Northumberland county, Pennsylvania, June 10.

This is for an improvement on that kind of cooking stoves which have two ovens, one back of the fire chamber, and the other under the fire chamber and top oven, and consists of a shield plate, back of the plate which separates the fire chamber and back oven, to protect the articles in the oven from being over heated; this shield plate is attached to, and projects from, a grate parallel with, and a few inches above, the bottom plate of this oven.

Claim.—"I wish it to be understood that I do not claim the diving flue, or double oven; but what I claim as my invention, and desire to secure by letters patent, is the shield plate attached to the grate in the manner and for the purpose set forth, so that it can be removed therewith at pleasure."

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16. For an improvement in the *Water-Wheel;* Daniel Weaver, McKeansburg, Schuylkill county, Pennsylvania, June 10.

The wheel, which is horizontal, and provided with radial buckets, parallel with the shaft, for about two-thirds their length, from the bottom up, and then inclined at an angle of about fifty degrees, is surrounded with tangent shutes, equal in number to the number of buckets, so as to discharge the water on every bucket of the wheel at once. These shutes discharge the water only on the inclined part of the buckets.

Claim.—"What I claim as my invention, is the combination of the wheel constructed as aforesaid, with the circle of shutes in the case in which the wheel is placed, as set forth."

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17. For improvements in the *Cooking Stove:* Calvin Fulton, Rochester, Monroe county, New York, June 10.

In this stove there are three plates between the fire chamber and oven; they are designated in the claim by the letters *a*, *b*, and *c*; *a*, being the fire back; *c*, the oven plate; and *b*, the one between the two, thus forming two spaces; the one between *b* and *c*, communicates with the flue space around the oven at the bottom only, no current of air being admitted to it; and the one between *a* and *b*, is opened for the circulation of air at the bottom and sides, to prevent the fire back from being over heated. The plate *a*, constitutes only the vertical part of the fire back, and at bottom it is connected with a curved plate *d*, which forms the lower and curved part of the fire back, the two being connected together by catches projecting from plate *d*, that

fit into holes in plate *a*, which lessens the tendency to warp. The hearth extends around the ends of the fire chamber, and has ledges projecting out to sustain the oven doors when opened.

Claim.—"What I claim as new, is the employment of three plates between the fire chamber and the oven; the foremost of these plates being divided into two parts *a* and *d*, these parts being connected together, and combined with the plates *b* and *c*, and with the body of the stove, as set forth. I claim also the manner of supporting the drop doors of the oven, by extending the lap, or hearth, back to them, as described."

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18. For an improvement in *Couplings for Carriages;* George W. Hatch, Parkman, Geauga county, Ohio, June 13.

The patentee says,—"The nature of my invention consists in providing the forward axle-tree of a wagon, or carriage, with a coupling which will allow the forward axle-tree an easy horizontal and vertical motion."

The horizontal wheel attached to the forward part of the carriage body rests on the axle-tree, which is provided with a curved plate, so that the axle-tree shall have room to vibrate vertically within a limited range, governed by the curvature given to the plate. At right angles to the curved plate, and attached to the axle-tree, there is another plate, the ends of which embrace the rim of the horizontal wheel to assist the king bolt in forming the connexion between the wheel and axle-tree. The head of the king bolt is round, and is received in a countersink in a cross-bar of the wheel.

Claim.—"What I claim as my invention, is the combination of the circular plate with the curved lower plate, the former being embraced by the hooks projecting from the latter; and in combination with these, I also claim the globe head of the king bolt fitting in the concave of the cross-bar, for the purpose and in the manner described."

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19. For an improvement in the *Cooking Stove;* John C. Hermance, Schenectady, New York, June 13.

This is for an improvement in the mode of heating the space between the bottom plate of the upper, and the top plate of the lower, oven, such spaces having long since been used in cooking stoves, but not arranged as this is, with the view of carrying through it a current of heated air; this is effected by connecting the space between the ovens on one side, with a space between the top oven and the fire chamber, which receives air from the room, and in which it is highly heated, and on the other side with the diving flue at the back of the stove, which causes the current of heated air to pass through the space between the two ovens.

Claim.—"What I claim as new, is the manner of arranging the heated air space between the upper and lower ovens, causing a current of highly heated air to pass through it by making perforations through the back oven plate in the manner set forth. I do not claim the use of a heated air chamber, or either of the other devices herein

named; but I limit my claim to the use of a heated air chamber, under the combination and arrangement thereof described."

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20. For *Self-Setting Head and Tail Blocks of Saw-Mill Carriages;* Joseph J. Parker, Plymouth, Washington county, Ohio, June 13.

We are under the necessity of omitting the claims in this instance, because they refer to, and are wholly dependent upon, the drawings. The improvements consist of an arrangement of inclined planes and slides, by which the log is lifted, and the slides moved, so that the weight of the log shall effect the setting, the slides being moved whilst the log is lifted up. By this arrangement the log is lifted up vertically by the motion of the carriage, and its weight transferred on to the slides, instead of pushing the log with its whole weight laterally.

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21. For an improvement in *Door Locks;* Linus Yale, Springfield, Hampden county, Mass., June 13.

We have here a rotating permutation lock; the key turns a plate, called a "tumbler" in the specification, which turns within a ring, and there are corresponding radial apertures in the tumbler and ring into which fit pins, or "pistons," that are caused to assume their proper positions, to admit of the turning of the tumbler, by the introduction of the key. On the lower face of this rotating tumbler there is a pin that works in a groove in the bolt, and at right angles with its length, to throw it in, or out.

Claim.—"What I claim as my invention, is the method of throwing the bolt, by means of the pin, on the rotary tumbler working in a groove in the bolt, in combination with the arrangement of pistons in the rotary tumbler and circular rim, as described."

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22. For an improvement in the *Cotton Press;* William Sewell, jr., Macon, Bibb county, Georgia, June 15.

This is for a modification of that kind of press in which pressure is made by means of two toggle-joints, arranged one on each side of, and under, the follower, the toggles being drawn together by means of cords, or chains, attached to the joints, and carried around a windlass, or windlasses, located between them. In the press under consideration, the upper arms are longer than the lower ones, and the windlass, or windlasses, are so located in height as to be considerably above the level of the joints when the follower is down, and on a level with them, or nearly so, when it is up; by which arrangement, "at the commencement of the operation the strain of the pressure is borne by the ropes, but as the arms are brought more nearly into a vertical position, the strain is gradually shifted, as the power of the arms increase, from the ropes to the arms."

Claim.—"I am aware that double toggle-joint presses have been constructed with a windlass stationed in the centre, between the said joints, and that pulleys have been used to draw together toggle-joints,

in which the ropes extended straight across from the centre joint of one, to the centre joint of the other toggle-joints; and that they have also been made with arms of unequal length; therefore, I do not claim either of these general principles; but what I do claim as my invention, is the combination and arrangement of the toggle-joints, as herein described, with the purchase fixed between said joints, in the manner and for the purpose set forth, so that the lower arms are allowed to fall into a horizontal position, and are raised by a purchase placed at a stationary point, and between them."

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23. For a mode of *Tanning Leather by means of a Flagellator;* Robert Downey, New Albany, Floyd county, Indiana, June 15.

The patentee says,—"The nature of my invention consists in flagellating, or whipping, the hides on the flesh side during and while in the first stages of being tanned. After ten, or fifteen, days, the hides may occasionally be flagellated on the grained side a little. Believing that one of the effects of the bark in the ordinary mode of tanning is to close the pores of the hide, and thus prevent that complete saturation with the bark liquor, which contains the tannin, and on which the perfection of the leather depends, in order to obviate this objection I propose the above named machine, which strikes about twenty-five hundred strokes a minute, and which raises and thickens the hide, and so opens the pores, that at the same time the gelatin and gluten are oozing out, the bark liquor is driven in with the machine, and the hide is made ready for the reception of another saturation, and may be placed either in the revolving, or stationary, handler, until again saturated, which may be known by the closing of the pores, and then the same operation is repeated."

The machine for this purpose, described in the patent, consists of a bed, or carriage, on which the hides are placed, and submitted to the action of a series of rods, or whips, working on a rod near one end, lifted by a series of tappets on a roller, and forced down by springs.

Claim.—"What I claim as my invention, is the flagellating, or whipping, the hides by means of the beaters, as herein described, or any other mode substantially the same."

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24. For improvements in the manner of preparing *Fabrics of Caoutchouc, or India Rubber;* Charles Goodyear, New York City, June 15.

The patentee says,—"My principal improvement consists in the combining of sulphur and white lead with india rubber, and in the submitting of the compound, thus formed, to the action of heat, at a regulated temperature; by which combination and exposure to heat it will be so far altered in its qualities as not to become softened by exposure to the solar rays, or of artificial heat, at a temperature below that to which it was submitted in its preparation, say to a heat of 270° of Fahrenheit's scale; nor will it be injuriously affected by exposure to cold; it will also resist the action of the expressed oils,

and that, likewise, of spirits of turpentine, and of the other essential oils, at common temperatures, which oils are its usual solvents."

The compound may be formed of various proportions of the ingredients, but that which is deemed best consists of twenty-five parts of india rubber, five of sulphur, and seven of white lead—the india rubber having been previously dissolved in some of the essential oils, and the sulphur and white lead ground in the manner of preparing paint.

Claim.—"I do hereby declare that I do not claim the combining of sulphur with caoutchouc either in the proportions named, or in any other, this combination having been the subject of a patent granted to me on the 24th day of February, 1839; but I do claim the combining of the said gum with sulphur, and with white lead, so as to form a triple compound, either in the proportions herein named, or in any other, within such limits as will produce a like result. And I will here remark, that although I have obtained the best result from the carbonate of lead, other salts of lead, or the oxides of that metal, may be substituted therefor, and will produce a good effect; I, therefore, under this head, claim the employment of either of the oxides, or salts of lead, in the place of the white lead, in the above named compound. I also claim the formation of a fabric of the india rubber by interposing layers of cotton batting between those of the gum, in the manner and for the purpose described. I likewise claim, in combination with the foregoing, the process of exposing the india rubber fabric to the action of a high degree of heat, such as is herein specified, by means of which my compound is effectually changed in its properties, so as to protect it from decomposition, or deterioration, by the action of those agents which have heretofore been found to produce that effect upon india rubber goods."

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25. For an improvement in *Horse Hames;* Nathan Post, Madrid St. Lawrence county, New York, June 15.

There are two curved levers attached to the front of the hames, and connected together, under the horse's neck, by means of a chain and snap hook. The draught hooks are attached to the hames, and pass around the levers, which, being extended some distance forward of the hames, and connected together, prevent them from twisting, or bending, under the pull of the horse.

Claim.—"What I claim is the combination of the hook and levers with the hames, substantially in the manner described."

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26. For a method of *Hardening and Coloring Wood, &c.;* Charles F. Spicker, New York, June 24.

Claim.—"What I claim as my invention, is the method of hardening and coloring wood by diffusing tannin, or tannic acid, together with vegetable colors, throughout the whole structure of the wood, and incorporating the same therewith, by the aid of caustic potassa, or soda, or other analogous substance, in the mode described, and in varying the color afterwards by the use of metallic salts, whose base has an affinity for tannin, or tannic acid, and also for the application

of the same process to manilla grass, and other articles used for cordage and ship rigging."

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27. For improvements in *Air-Heating Furnaces;* Jephtha Bradley, St. Albans, Franklin county, Vermont, June 24.

The grates at the bottom of the fire chamber, on which the fuel rests, are tubular, and communicate at the back with a chamber at the back of the fire chamber, the upper part of which extends over this air chamber in the form of a flue communicating with a long, flat flue above the fire chamber, divided horizontally, by a partition, from the back to within a short distance of the front, leaving space for the draught to pass to the upper division, and from thence out at the pipe, or chimney. This double return flue is surrounded by an air chamber; and, in addition to these, there are other air chambers at the sides of the fire chamber, and the whole is surrounded by a double casing. The side and back air chambers, and, consequently, the whole of the grate bars communicate with the upper air chamber that surrounds the double return flues. In the claim the side air chambers are designated by the letter *i*, the back chamber by the letter *d*, the upper one by the letter *k*, and the double return flue, which it surrounds, by the letter *f*.

Claim.—"What I claim as my invention, is the combination of the air chambers *i*, *i*, and *d*, *k*, surrounding the fire, with the tube grate, the chamber *k*, having a double return flue *f*, therein, as described."

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28. For an improvement in the *Press;* Amos Jackson, New Liberty, Adams county, Illinois, June 24.

The bed of this press is a long lever, nearly horizontal, one end of which is jointed to an inclined piece of timber, at an angle of about 45°; and the follower of the press is another lever above the first, and connected with it at one end by a sword jointed to the lower lever, or bed, and passed through a mortise in the end of the upper lever, or follower, where the two are connected by a pin, which fits into holes in the sword, in the usual manner of forming such adjustable connexions; the other end of this upper lever is mortised, and embraces the inclined piece of timber. The bottom lever, or bed, is lifted up by a windlass and cords, and when liberated makes pressure by its gravity, and that of the upper lever. The articles to be pressed are placed between these two levers, and when their linked ends descend, that end of the upper one, which embraces the inclined timber, is made to approach the lower one, in consequence of the inclination of the timber.

Claim.—"What I claim as my invention, is the combination of the inclined plane with the levers, arranged and operated in the manner set forth, for the purpose specified."

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29. For an improvement in *Bee Hives;* James A. Cutting, Haverhill, Grafton county, New Hampshire, June 24.

Within the bee house there are three drawers, two at the bottom,

side by side, and one above them which extends over the two lower ones. The drawers communicate together by numerous small holes, which may be closed, or opened, by slides, having corresponding holes. The drawers are provided with tubes, for the admission of the bees, and those in the lower drawers are located at the junction of the two drawers, to give an entrance to the two drawers by the same tube, which is, however, divided by the partition between the two drawers. There are two of these tubes, one at the bottom, and the other about the middle of the height of the drawers.

Claim.—"What I claim is the employment of separate, or double, slides between the drawers, one for each, constructed and arranged in the manner and for the purpose set forth. I also claim the divided tubes, in combination with the drawers, constructed and arranged substantially in the manner and for the purpose set forth."

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30. For an improvement in *Tanning Leather;* Adam Kettering, and Augustus Vogle, Hempfield, Westmoreland county, Pennsylvania, June 24.

The vats are divided into five sections, each section being divided again into two compartments, one for holding the tan bark, and the other for the hides, the partition between the two being pierced with holes for the passage of the liquor; water is pumped on to the bark in the first vat, which, after receiving a certain degree of tannin, and acting on the leather, is pumped on to the bark in vat number two, where it receives additional strength, and so on throughout the series, the leather being also shifted from vat to vat through the series, as the process of tanning progresses.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the above described process of tanning hides into leather in a quicker manner than usual, and without the aid of steam, or any chemical composition, and, in connexion therewith, the peculiar arrangement of the vats used for said purpose, also as set forth."

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31. For an improvement in the *Cooking Stove;* Henry W. Camp, Owego, Tioga county, New York, June 24.

In this stove, as in many others before it, there are two ovens, one back, and on a level with the fire chamber, and the other below, there being a flue space between the top of this and the bottom of the upper oven and fire chamber, and a diving flue between the fire chamber and upper oven, and one back of the upper oven divided into three compartments. When it is desired to heat the upper oven only, a damper at the top of the flue between the fire chamber and oven is opened, which directs the draught down this flue under the oven, and up the middle division of the back flue to the pipe; but when the two ovens are to be heated, this damper is closed, and a damper that governs the two outside divisions of the back flue are opened, which directs the draught over the top oven, down the outside divisions of the back flue, over the top of the bottom flue, down the front flue,

under the oven, up the back flue of the bottom oven, and then to the pipe through the middle division of the back flue.

Claim.—"What I claim as new is the particular arrangement of the flues and valves, as set forth. I do not claim either, or any, of these, excepting under the special arrangement and combination thereof, above made known, and by which they are rendered susceptible of the various changes described."

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32. For an improvement in the *Flax and Hemp Brake;* Aaron F. Bruce, Marshall, Salina county, Missouri, June 24.

This is for an improvement in the common Dutch hand brake, which consists in dividing the standards and beams, to which the swords are attached, that they may have sufficient elasticity to yield and permit the swords to accommodate themselves to the varying bulks of hemp, and prevent the breaking of the fibres. In the hand brake the hand of the operator regulates the strength of the blow, and yields whenever it is required; but as this machine is to be worked by power, and the brake has a positive motion, the yielding of the swords becomes indispensable, in the judgment of the patentee.

Claim.—"What I claim as new, is the manner of giving the necessary lateral play to the vibrating and stationary swords, so as to accommodate themselves to the varying bulk of the material, by attaching the swords to the divided beams, and divided standards, as described."

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33. For improvements in machinery for *Cutting and Dressing Stone;* Jacob Jenks, Roscoe, Winnebago county, Illinois, June 24.

The patentee says,—"The nature of my invention consists in a cutting tool that extends across the stone, said tool having a row of picks on its front edge, and just behind them, a broad chisel, the tool being vibrated, and by its weight and momentum, cuts the stone which passes under it on a carriage; side cutters of a similar construction are attached, and vibrate horizontally to cut the sides of the stone."

These cutters are attached to stocks that vibrate on centres, and, therefore, the picks and chisels cut by a vibrating circular motion communicated to them by appropriate machinery.

Claim.—"What I claim as my invention, is the cutter-head, constructed and arranged as described, having chisels and picks attached thereto enough to extend across from one side of the stone to the other in a line, and all operating at once the whole width of the stone, in the manner and for the purpose described. I also claim, in combination therewith, the side cutters constructed and arranged as above specified."

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34. For an improvement in *Piano Fortes, Harps, and other String Instruments;* Lovering Ricketts, Baltimore, Maryland, June 24.

Instead of attaching the strings to pins, in the usual manner, they are hooked on the end of metallic springs, which project from studs

attached to the instruments. The inventor states that his object is to keep instruments in tune, by the elasticity of the spring connexion, which yields as the strings contract.

Claim.—"What I claim as my invention, is the application of my metallic springs to the piano, harp, and all other musical string instruments, as an improved substitute for the common hitch pins now used, and for the purpose of keeping them in tune for a long period of time."

Patent Re-issued in the month of June, 1844.

For improvements in *Boxes for the Journals of Railroad Cars, &c.;* John H. Tims, Newark, Essex county, New Jersey, June 13.

This patent was granted on the 31st of October, 1839, and noticed in this Journal at page 394, vol. xxvi, to which the reader is referred; and as the re-issue was granted for amendments in the specification, it only becomes necessary, in this place, to insert the claim.

Claim.—"I do not claim, as my invention, the supplying of oil to the journals of axles, by means of sponge, or other similar substance, as that has heretofore been done; nor do I claim the invention of a cup, or saving chamber, placed under the bearing of a journal, as cups, open and exposed to the dirt,, and from which the oil could be spilled by the jar of the car in motion, have been used; neither do I claim a washer, or cap, from the hub of a wheel, as that is now applied to common carriages; but what I do claim as my invention, is constructing the box in the manner described, having two recesses, or compartments, in its lower section, into one of which sponge, or other suitable elastic substance, is fitted, so as, when saturated with oil, to lubricate the journal with which it comes in contact, the other chamber being made to receive the oil that flows over from the first compartment, the oil being conveyed to said chambers through a conductor that enters the supply chamber under the journal; the whole being combined substantially as set forth. I also claim the particular manner in which I have constructed the journal and its bearings, grooves and cap, in combination with the foregoing lubricating apparatus, consisting of the fillet, or tongue, and the recess in the bearings for checking the lateral motion of the bearing, and the grooves and washer for retaining the oil, in combination, as set forth."

List of American Patents which issued in the month of October, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *Examiner of Patents.*

(Continued from Page 72.)

22. For an improvement in *Wire Heddles;* Abraham Howe, and Sydney S. Grannis, Morrisville, Madison county, New York, October 11.

Heddles have heretofore been made in two parts, jointed together

by a loop at, or near, the eye through which the warp passes, which has been alleged to be an objection, and the improvement in question is for making them in one piece, or in two pieces, jointed at the ends.

Claim.—"What we claim is the making of such heddles in one continuous piece from end to end without a joint, and this we claim whether said heddles be made of one entire piece of wire recurved at one end, to form the end eye, or of two pieces of wire, each having the end eyes formed by twisting the ends of the wires round in the ordinary manner."

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23. For an improvement in the *Spiral Water-Wheel;* John G. Garretson, Muhlenburg, Pickaway county, Ohio, October 11.

This wheel is formed in the manner of an Archimedean screw, but placed with its shaft vertical, so that it acts directly by the gravitating force of the water; and the edges of the spiral buckets, or the screw, take into cogs on a wheel, (called by the patentee the "waiter wheel,") by which the power is to be transferred to a mill, or other machinery.

Claim.—"Now what I claim to be my invention, is the combination of the spire wheel, and the case surrounding it with the wheel which I denominate the waiter, the whole being constructed and operating in the manner set forth, forming a propelling power for mills and machinery receiving and transmitting the power of descending water."

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24. For an improvement in the *Parlor Stove;* Joseph Feinour, Jr., Philadelphia, Pennsylvania, October 11.

We make the following extract from the specification, viz.,—"Upon a quadrangular, or other suitably formed, pedestal, I place a cylinder of sheet-iron, within which is contained the fire place; the lower part of this, which is to contain the fuel, is a low cast-iron cylinder that is lined with fire clay. The pedestal contains the ash-pit drawer, and extends back, so as to receive air in its rear part, four tubes, or columns, through which the draught from the fire may be directed, the upper ends of which enter a heated air chamber similar in dimensions to the pedestal. The fire chamber is surrounded by a cast-iron cylinder, or rather a conical body, which, with the fire chamber, is surrounded by the sheet-iron cylinder that forms the exterior of the stove. The fire grate turns upon pivots, as is well known, and may be shaken up and down. There is a space between the outer cylinder and fire chamber, for the passage of heated air, which is supplied to it by a pipe that passes through the pedestal, to take the air from near the floor, or out doors. This pipe opens into the cylinder, so as to cause the cool air to strike against the fire chamber, and, when heated, passes into the room through apertures in the cylinder. Immediately above the fire cylinder, and contained principally within the hot air chamber, is an air heater, closed at its lower end, which is exposed to the direct heat of the fire, except that there is an opening into its lower part, by means of a pipe from the exterior of the

sheet-iron cylinder, which opening admits air from the room that will become heated, and escape into the room through a grated cover. The pedestal behind the ash drawer forms a draught space for heated air, which may be made to descend two of the columns leading from the upper hot air chamber, and to ascend the other two on its way to the exit, or smoke, pipe, which leads from the hot air chamber into a fire place. By means of a valve in the upper hot air chamber, a direct passage may be allowed from the fire to the exit pipe. There is also a pipe in the pedestal, behind the ash drawer, which forms a part of a partition dividing the pedestal into two chambers, and which, when it is desired to lessen the force of the fire, may be opened for that purpose, whilst the upper door of the stove may remain closed. The air that enters at the opening of the ash drawer will then pass directly back to the columns behind the stove, instead of through the fuel, preventing its free combustion, and the escape of gas into the room, which is apt to occur when the upper door is opened."

Claim.—"What I claim is the arranging of the damper between the ash-pit and the heated air chamber of the pedestal, for the purpose described. I claim the manner in which I have arranged and combined the fire chamber, the cast-iron cylinder, or cone, the sheet-iron cylinder furnished with openings, and the cool air pipe leading into the space, in the manner and for the purpose made known. I claim the manner of arranging the air heating cylinder above the fire chamber, and passing through the heated air chamber, having also an opening into it for the admission of air, and being furnished with a grated cover for its escape, after being heated in its passage through the cylinder."

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25. For improvements in the *Rotary Steam Engine;* L. A. Stewart, Cross Plains, Robertson county, Tennessee, October 11.

This is for improvements on Murdock's rotary engine, patented in England some forty years since, in which the steam acts against the cogs of two wheels. The improvements are pointed out with sufficient clearness in the claims.

Claim.—"What I claim is the manner of constructing, combining, and arranging the cap and cheek pieces, so as to embrace under the cap but a small portion of each wheel, employing the cap and cheek pieces, in lieu of the close case, or cases, hitherto used in such machines, and introducing the steam through the caps between each pair of wheels. I claim the combining with these caps the weighted levers for pressing them down on the teeth of the wheels, thus preserving them in close contact, without the necessity of any elastic packing. I claim the manner of preventing binding, or cramping, in said pairs of wheels, by the combined operation of the end play of the axles of two of them, and of the play of one of them in the direction of its revolution. I claim the using of the steam on a second pair of wheels, by conducting it from the first pair through the cap of the second pair, in the manner set forth."

26. For improvements in the machine for *Planting Seeds;* Joseph Jones, Newton, Gloucester county, New Jersey, October 11.

We have here alleged improvements on that kind of planting machines in which the seeds are carried into the dropping tube from the hopper by means of a slide; and the first improvement consists in placing the rest board, on which the slide works, directly under the aperture in the hopper, so as to leave a passage into the dropping tube on each side of the rest-board, that seed may be discharged on either side at each back and forward movement of the dropping slide. The covering roller has its bearings in two arms jointed to the frame, and to two segments provided with a set screw, by means of which the depth of the machine may be regulated.

Claim.—"What I claim, is, first, the method of combining the rest board with the spout and slide, by arranging the rest board over the centre of the spout under the slide, so as to leave a passage at either side of the board for admitting the seed into the spout on both the forward and backward motion of the slide; and in combination with said arrangement the method of adjusting the rest board by means of screws; second, the combination of the arms, segments, and screws, for adjusting the height of the roller for causing the plough to enter more, or less, as well as for rolling, as described."

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27. For an improvement in the *Hydraulic and Pneumatic Cock;* John Lee Chapman, Baltimore, Maryland, October 11.

There is a cylindrical hole in the head of the cock, extending from, and at right angles to, the aperture, for the passage of the fluid, in which slides a cylindrical plug, having the lower end made conical, to fit into a conical recess in the body of the cock, and intercepting the aperture for the passage of the liquid. The conical and cylindrical parts of this plug are covered with leather packing, and the upper end is squared to fit and slide in the cap, which is screwed on to the head with leather packing interposed; and this cap has another cap screwed on to it, for the purpose of retaining the key, by a flanch on the body of it, which is tapped into the upper end of the plug, for the purpose of working it up, or down, to open, or close, the aperture.

Claim.—"I claim the manner of forming the plug, and the chamber within which it operates; the lower part of said plug being made conical, and adapted to the closing of the passage of fluids through the cocks; and the upper portion thereof being cylindrical, and so packed as to be rendered air and water-tight, substantially in the manner and for the purpose herein described. And I do hereby declare that although I have represented and described the particular manner in which I put the respective parts of the instrument together, and which I consider to be the best arrangement thereof, I do not intend to limit, or confine, myself to this precise mode, but to vary the same as I may think proper, whilst the part upon which the severe action of the cock is dependent, are combined and operate substantially as set forth."

28. For improvements in *Self-Acting Mules, Billeys, Jennies, Jack Frames, &c.;* Richard Roberts, Manchester, England, October 11.

We are under the necessity of omitting a descriptive notice of this invention on account of its complexity, as the attempt to give any idea of its character, in the narrow limits of a sketch, would be vain. This omission is the less to be regretted, from the circumstance that the description and drawings will be found at large in the *Repertory of Patent Inventions;* but we insert the claim for the benefit of those who are acquainted with the mechanism, and who may desire to be informed of the limits of the letters patent granted in the United States.

Claim.—"Having described my improved mechanism for adapting the rotation of the spindles to the regular taking up of the yarn as the form and diameter of the cop changes, throughout the operation of winding on; I do hereby declare that my invention consists in the method, or means, to be employed for that purpose herein before described. The mechanism thus employed by me effects the rotation of the spindles in two ways; first, rotary motion is given to a drum, or barrel, which turns the spindles, whilst the carriage is running in, by uncoiling from it a portion of a cord, strap, or chain, attached to the drum, and having its other extremity fastened at some point in a radial arm which describes an arc, whilst the winding on drum is receding from the point of attachment of the cord in a right line. This compound motion adjusts the rotation of the spindles to the varying power of taking up by the conical cop, as the yarn, or roving, is being coiled on its different diameters during the winding on of each stretch. Secondly, during the progress of the formation of a cop the situation of the point of attachment of the uncoiled end of the cord, strap, or chain, on the radial arm, is changed progressively, as the increasing bulk of the cop demands fewer revolutions of the spindles to take up the stretch, and, consequently, there is a shorter length of the cord to be uncoiled from the barrel. And I declare that the form and proportions of the different parts of my improved mule, as well as the materials of which the same may be composed, may be varied according to the discretion of the workman employed in constructing the same, without departing from the object and principle of my improvements."

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29. For an improvement in the *Boiler, or Caldron;* Lansing E. Hopkins, New York City, October 11.

The fire place, or furnace, is surrounded by a boiler, except where the door for the fuel is placed, and the smoke pipe, or chimney, passes out through the top of the boiler, and the caldron is let in the top of the boiler, so that its bottom and sides are exposed to the direct action of the vapor in the upper part of the boiler.

Claim.—"What I claim is the particular manner of arranging and combining the furnace, the steam boiler, or generator, and the caldron; the general form and arrangement of these parts being substantially the same with those described; without, however, intending, by the

accompanying description and representation, to limit myself to any precise shape, or proportions, of the respective parts, but to vary these as I may find convenient."

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30. For *Pneumatic Springs applied to Railroad Cars;* Levi Bissell, Newark, Essex county, New Jersey, October 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of compressed air, or other permanently elastic fluid, in a cylindrical, or other shaped, vessel, made of metal, or other hard substance, and acting against a piston working therein, for the purpose of springs for railroad cars, or other carriages."

It may be well to say, that at the time application was made for letters patent for this supposed invention, the applicant was informed that it was known to the officers of the department, that this device had been applied to carriages, and used for various other purposes, as a substitute for metal springs; but that after a diligent search in the records of the office, and the library, which, unfortunately, is too limited, no evidence could be found, such as the law requires the commissioner to furnish, on refusing to grant letters patent, and that, therefore, it was optional with him to demand one, or withdraw his application; that he might, however, rest assured that if he did obtain a patent he would not be able to sustain it. He did insist on the grant, and some time afterwards he was furnished with the evidence of the want of novelty.

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31. For an improvement in the *Elevated Oven for Cooking Stoves;* Rensselaer D. Granger, Albany, New York, October 11.

Claim.—"What I claim is the manner in which I have constructed the elevated oven by extending flat flues at either end by means of end plates, arranged and operating substantially as set forth; the heated air from the fire chamber entering the lower flue, and escaping from the upper, in the manner described."

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32. For a mode of rendering the *Pockets of Garments Safe against Pickpockets;* Daniel Harrington, Philadelphia, Pennsylvania, October 11.

The surface of the pocket is covered with fine metallic chain, or with metallic, or other buttons, or quilted with metallic wire. And to prevent a pocket, &c., from being cut away, one, or more, strands of chain are carried from the pockets to some other part of the dress. These are described as applicable to reticule bags, and other similar bags.

Claim.—"What I claim as my invention, is combining pockets constructed substantially as described, with the various articles of wearing apparel set forth."

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33. For improvements in the *Cooking Range;* N. P. Kingsley, Boston, Massachusetts, October 11.

"The object of these improvements is to so combine the parts of a cooking range as to secure conveniences for effectually performing the several culinary operations of roasting, baking, boiling, &c., and at the same time to warm the building, by heating and diffusing hot air through the apartments, which air shall not be charged, or mingled, with the effluvia which are necessarily produced by the various cooking operations."

The fire chamber, or fire pot, is semi-cylindrical, with the flat side to the front, and the curved part inclosed by two side flue spaces; it has a grate at the bottom, and one on each side, communicating with the side flue spaces; and from these side flue spaces there are two branch pipes that lead from opposite sides into the main draught pipe which runs directly from the upper and back part of the fire pot. The cold air enters from the back, passes around partitions, and enters and circulates around the side flue spaces, pipes, oven, &c., and passes off to the apartments to be heated; and the gases, &c., from the cooking are carried off through pipes above the oven and cooking pans, &c.

Claim.—"I shall claim, first, forming two side gratings in the fire pot of a cooking range communicating with two flue apartments on the sides of the same, through which gratings the smoke, &c., may pass to the said apartments; the whole being arranged and operating substantially in the manner, and for securing the effects herein before specified. Secondly, the method of combining the semi-cylindrical fire pot, (having grated openings,) with the flue spaces on either side of it, by arranging the flat surface of the pot on a line with the plates constituting the fronts of said spaces, so as to form a part of the front of the range, and covering both the fire pot and flue spaces with a top plate, so as to form a chamber on either side of the fire pot—the surface of the fire pot forming a portion of said chambers as described."

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34. For an improvement in the *Condenser of a Woolen Carding Engine;* Levi L. Gowdy, Montgomery, Orange county, New York, October 11.

Between the carding cylinder and condensing tubes, there is a set of vertical separators, or rods, and two horizontal rollers to separate the strands of roping, and prevent them from twisting together.

Claim.—"What I claim as my invention, is the application to the condenser of the woolen carding machine of a series of separators, in combination with two rollers placed between the tubes and cards, for the purpose of separating the strands, or roping, and preventing them from being twisted together."

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35. For improvements in machinery for *Grinding, Moulding, and Pressing Clay into the form of Bricks;* Charles G. Brown, Caldwell, Rockland county, New York, October 11.

The clay is mixed in a tub by means of arms attached to a vertical shaft rotating within it, and is forced out into the moulds at the side and on a level with the bottom; the moulds being carried under the press and conveyed away by an endless chain.

The claim refers throughout to the drawings, which are numerous and complex, and could not be understood without them, and, therefore, we are under the necessity of simply pointing out to what improvements it is confined and limited. The first, is to the employment of clack valves fitted to openings in the driver of the press, to admit air on the rising of the driver, and thereby prevent the brick from adhering to it. The second is to a mode of regulating the pressure by having the rod of the driver made in two parts sliding on each other, and connected together by a cord passing around pulleys on both, and connected to a weighted lever, so that in case of any impediment to the movement of the driver, the part of the rod in connexion with the power, will lift the weighted lever without moving the driver. The third is to an arrangement and combination of latches, catches, and levers, for moving the endless chain that carries the moulds. The fourth, is to a mode of preventing breakage by hard substances obstructing the motion of the endless chain carrying the moulds, by connecting it with the lever, that moves it by means of a weighted lever, this connexion being effected by an arrangement of levers and cords. The fifth, is to the mode of constructing the metal grates with openings narrower in, or near, the middle, than at the ends, for the purpose of pressing the clay through the same, so that it shall fill the ends and corners of the mould beneath equally with the middle parts of the moulds, thereby avoiding any partial removal of the moulding sand, and preventing the clay from sticking in the moulds. The sixth, is for the mode of pressing the bricks by the momentum of a weight on the end of a lever jointed to the driver rod, and combining with this the parts for lifting the driver, which is suspended to a lever operated on by a cam on a rotating shaft so formed as to lift the driver gradually, and liberate it suddenly. The seventh, is to the mode of adjusting the moulds in place to be sent on under the pressing chamber, to be filled by a spring on one end, and a gauge bar moved by a lever and parallel links. The eighth, is to the mode of driving the moulds under the press chamber, by means of a driver and arms on a rock shaft, in combination with a vertical rod, and a cam on a horizontal shaft at the top of the machine; and the ninth, is to the mode of preventing breakage from hard substances passing through the grates into the moulds, so as to obstruct the moulds by a combination of parts connecting the whole with a weighted lever.

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36. For an improvement in the *Self-Oiling Bush for Mills;* George M. Copeland, Genoa, Delaware county, Ohio, October 11.

The curb, or inner periphery, is so formed as to leave a space for packing between the bush and spindle, and is provided with apertures to admit the oil to percolate and pass to the packing from chambers on the outside.

Claim.—"What I claim as my invention, is making a space within the curb to admit packing around the spindle, as described, and in combination therewith the openings from the reservoir cups to supply oil to the packing, as described."

37. For an improved mode of preventing *Cotton, or Wool, from falling to waste from the Carding Machine;* Joseph Munroe, Palmer, Hampden county, Massachusetts, October 11.

The patentee says,—"The nature of my invention consists in providing the under side of the carding machine with a screen, or sieve, in such a manner that the dirt, which the cotton, or wool, contains, may fall through the screen, while the cotton, or wool, is kept in contact with the cylinder of the carding machine by means of the screen, and not permitted to fall down under the machine, and go to waste."

Claim.—"What I claim as my invention, is the application to carding machines of a screen which will permit the dirt, motes, &c., to escape, without the cotton, or wool, as described."

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38. For an improvement in the *Jaws of Bench Vices;* William Sim, Schenectady, New York, October 11.

This is for making cast-iron bench vices with steel jaws, or facing the jaws with steel, by casting the body of the vice on to the steel plates, which form the facings of the jaws.

Claim.—"I claim the manner in which the steel face, or lip, of the jaws, as described, is formed and constructed, and the manner of joining the lip thus constructed of steel to the jaws, by casting the lip of steel separately with three, or more, holes, and then placing the steel lip in the mould where the jaw is to be formed, and in this manner uniting the lip of steel to the iron jaw, thus forming the jaws of distinct metals, and in a simple and durable manner, as described."

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39. For an improvement in *Railroad Cars for Running on Curves;* Perry G. Gardiner, assignee of Isaac Bullock, New York City, October 11.

This improvement is for the purpose of throwing the axles of the wheels in the radii when the car passes over a curve; each wheel is on a separate axle, that has its bearings in a frame extending from the outside to within a short distance of the middle of the truck frame. The outer ends of the wheel frames are jointed to the truck, and the inner end of the right hand back frame is connected by a joint rod with the inner end of the left hand forward frame, and the other two in the same manner, and the inner end of the two back frames are connected with the two T arms of a T lever; the third arm of which is for the front car, attached to the axle of two leading, or guide, wheels, and for the other cars, to the back of the preceding car, and for the back truck of double truck cars, to the back of the front truck. From this arrangement, it is evident that the moment the (*t*) lever is, by the leader, or preceding car, thrown in the direction of the radii, the axles of the wheels must, of necessity, follow."

Claim.—"I do hereby declare, that I do not claim the mere cutting of the axle into two parts, so as to run independently of each other, nor do I claim running each wheel in a separate vibrating frame connected with the frames of the other wheels, by means of connecting

rods, these having been done, but without the farther connexion hereafter claimed; but what I do claim as constituting my invention, and desire to secure by letters patent, is so connecting the sliding boxes, (for the frames in which the wheels revolve,) by means of connecting rods with a lever in the form of a cross, or letter T, (which connects the car with the next preceding car, or in case two, or more, trucks carry one frame, may connect the said trucks with the said frame,) as to adjust all the wheels simultaneously, and enable them to receive the adjustment from the preceding car, or frame, or from the frame of the car itself when two, or more, trucks carry one frame, all substantially, as described."

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40. For an improvement in the *Valves and Pistons of Pumps;* John Clark, Portsmouth, Norfolk county, Virginia, October 11.

The nature of this improvement is distinctly pointed out in the following—

Claim.—"What I claim as new, is the attaching of the pistons and valves, the former to the piston rod, and the latter to a rod, or bar, of metal, by a joint pin out of their centres, by which they will be enabled to tilt, and allow the passage of water upwards, and will resume their horizontal position when the water, or other liquid, is not ascending within the pump; the said valve being made so as to occupy the whole section of the barrel of the pump, and the arrangement and operation of the respective parts being substantially such as are described and made known."

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41. For an improvement in the *Steam Boiler for culinary purposes, &c.;* Solomon C. Riley, New York City, October 11.

The fire is contained in a cylinder, or pot, which is surrounded by another cylinder, leaving a space between the two for water, which constitutes the boiler. The space uniting the two cylinders at top may be provided with cooking holes, and a steam pipe, and the top of the fire cylinder may be adapted to receive either a caldron, or a plate, with several boiler holes.

Claim.—"I do not claim the discovery of a double cylinder, or the use of the caldron; but what I do claim as new, is first, the combination of the double cylinder, boiler, and caldron with the space between the double cylinder left open at top. Second, the same with a cap pierced with kettle holes, for the purposes described."

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42. For an improvement in *Traveling Trunks;* John Fitzgibbons, Philadelphia, Pennsylvania, October 11.

Claim.—"What I claim as new, is the constructing of trunks, and other articles of similar character, with their front and back sides rendered alike in appearance, by covering the key holes with screwed knobs, resembling the rows of knobs used to ornament and strengthen such articles, and by making the strip which forms the cover of the opening between the lid and the lower part of the trunk of hoop iron, or other rigid substance, covered with leather, or other suitable ma-

terial, and by riveting the back straps of the hinges to said strip forming the ledge, and by otherwise arranging the respective parts in the manner set forth; these parts being claimed only in combination with each other, so as to attain the end which is the object of this invention."

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43. For an improved *Apparatus, or Instrument, for Counting Coins, and other articles of similar character;* Philos B. Tyler, executor of Rufus Tyler, deceased, Branch Mint, Louisiana, October 11.

This instrument consists of a square board, or plate, with parallel strips, or ledges, projecting from its surface about the thickness of the coin to be counted, and at distances apart equal to the diameter of the said coin, and at one end there is another ledge, or strip, at right angles to the parallel ledges, thus forming troughs, or receptacles, for the reception of the pieces of coin.

Claim.—"What is claimed, is the described manner of dividing the face of the instrument into a series of separate shallow troughs, by means of the strips of metal, in combination with the strip placed at one end thereof; said strip not rising higher than the thickness of the coin to be counted—the whole being arranged, combined, and employed for the purpose, and substantially in the manner made known."

Improvements added to previously granted Letters Patent, during the month of October, 1841.

1. For improvements in the *Counter Twist Speeder;* Jesse Whitehead, Manchester, Chesterfield county, Virginia, October 11.

This is for improvements on a counter twist speeder patented to Jesse Whitehead on the 29th of May, 1841, and noticed in this journal at page 51, of the fourth volume, third series, to which the reader is referred.

The first improvement is for making a groove in the revolving block, or roller, which receives the roping from the condensing belt, and conducts it to the bobbin, instead of the curved and grooved guide, described in the original patent. The second, is for the method of doffing the spools, after they are filled, by means of a plate which projects from a horizontal shaft, and which extends under the spool, the shaft being provided with a handle, by which the plate is brought up under the spool, and lifts its journals from the forks in which they work, and permits it to roll back on to a table, thus leaving a portion of the roping on the plate in a convenient position for the operator. And the third improvement is for hinging the guide, which is placed between the grooved block, or roller, and the condensing belt, so that it can be thrown back when the operator wishes to introduce the roping in the groove of the block, and which also permits it to yield when a knot in the roping passes between it and the block, or roller. We are under the necessity of omitting the claims, as they refer to the drawings, and could not well be understood without them.

FRANKLIN INSTITUTE.

Extracts from the Reports of the Judges appointed to examine the Articles offered at the Fourteenth Exhibition of American Manufactures; held October, 1844.

Report on Silk Goods.

Although nothing particularly new, or remarkable, in the article of Silk has been submitted to your committee, yet it is highly gratifying to notice the continued efforts to advance so interesting and important a branch of manufacture; and when we contrast the incipient stages of the manufacture of cotton, with the great perfection to which it has now attained among us, we cannot but feel encouraged to hope, that the active and untiring genius of this people will yet place the silk manufacture in the fore-front of the productions of this country.

Report on Musical Instruments.

The number of piano fortes at the exhibition is smaller than it has been for several years, and the improvement which they indicate in the art of manufacturing them is not remarkable. Several of the instruments were, however, of excellent character, well made, and, in all respects, such as to confirm the opinions heretofore expressed in favor of the establishments from which they come. Those from Mr. Gale, of New York, and Meyer, of Philadelphia, are of this class. The committee, however, do not think themselves justified in asking for these, or the other exhibitors, among whom several presented good specimens of work, any of the marks of distinction within the power of the Institute.

The improved double action harp (No. 2028, exhibition number,) may fairly challenge rivalry with the best imported instruments of the kind. Its plan of construction, workmanship, tone, and appearance are worthy of very high praise. The only doubt that has arisen in the minds of the committee as to the propriety of awarding to it the Institute's medal, originates in the fact, that in an engraving upon the body of the instrument the maker's residence is said to be in *London*, and the decorative engravings on the reverse are to the same effect. Evidence has been presented to the committee going to show that the instrument is, *in fact*, *American;* as is declared also by the engraved plate which covers the European inscription, and that the London mark, which is that of a branch of the same establishment, was assumed merely as a *sale mark*, in consequence of the general want of reputation of American harps. If the committee on exhibitions find, in this circumstance, no objection to the grant of the medal, then the undersigned would recommend that the medal should be awarded to No. 2028.

The evidence, presented by the exhibitor of the harp, is herewith submitted. It is probably intended to cover the whole ground of

American character. It may be made clearer, however, by distinct proof, that the mechanism of the instrument, which is found between the two engraved plates at the top, and includes the most difficult, and, therefore, most meritorious part of it, was itself made in this country. This remark is not made in a jealous spirit, but with the view of guarding both the manufacturer and the Institute from insidious criticism hereafter.

The wind instruments from Mr. Weygandt were, as heretofore, meritorious.

Report on China, Glass, and Earthenware.

The judges on china, glass and earthenware, respectfully report, that but two invoices were entered on their list; these were, of glass ware:

No. 1036. Made by M. & R. H. Sweeny, of Wheeling, Va., deposited by Jos. Bell—an invoice of flint glass, comprising one very large and beautiful covered bowl, fruit bowls, celleries, pitchers, decanters, tumblers, and wine and jelly glasses, all richly cut. This glass is of uniform quality throughout, remarkably clear and brilliant, and will compare favorably with the best ever brought to these exhibitions. The judges recommend the award of a silver medal to this lot.

No. 1051. Made by The Boston and Sandwich Glass Co., deposited by Wm. M. Muzzey—an invoice of colored glass, far surpassing in excellence, any colored glass ever before made in this country. The amber, carnelian and ruby have been imparted with such admirable success, that there is but little room left for improvement, and the combination of colors in some of the specimens, has produced tinges exceedingly beautiful. The specimens of opaque glass of various colors and shades, are new and eminently successful. The judges recommend the award of a silver medal to The Boston and Sandwich Glass Co., for their success in the manufacture of colored glass.

The display of glass at this exhibition, though small, has not been surpassed in point of interest. The manufacturers say they have been so busy making goods to order, that they have been unable to furnish many for exhibition; which, it is presumed, is the best evidence they desire that the art is flourishing.

The samples furnished by the Messrs. Sweeny, prove that the difficulty heretofore experienced in producing good color and brilliance in the article, west of the mountains, has been overcome; and that they are now prepared to furnish the best and purest flint glass.

We have been dependent on foreign manufacture for our colored glass in a great measure, but the Boston and Sandwich Co., who have erected a furnace on purpose for making it, have shown, that henceforth it will be unnecessary to go from home for any description of the article. It is not a large item in our commerce, but it is an item, and consequently a step advance in the manufactures of our country.

Report on Chemicals.

The committee of judges upon Chemicals respectfully report, that

in their opinion, the Institute has great reason to be gratified by the variety and excellence of the preparations, although they regret to notice the absence of several names which have generally graced their display.

No. 503, extract of indigo, by A. Gunn; a very neat form of exhibiting the dye, and worthy the attention of manufacturers. The committee cannot go into such an investigation as must be necessary to decide fully upon its merits.

No. 505, indelible ink with mordant, Potts, Linn & Harris.

No. 506, indelible ink without mordant, Barnhill.

As to the merits of these nothing but long experience can decide; the specimens of writing look well. One of the committee has tried No. 506, and speaks favorably of its color.

No. 509, sugar, from Lovering & Co.; a very beautiful, white, and crystaline sugar; remarkable for the size of the grain, and for the purity of its color. Its appearance sustains the reputation which the manufacturers gained at the last exhibition.

No. 518, spermaceti, Alexander H. Campbell; a preparation of exceeding beauty and purity, and well worthy the attention of every one.

No. 521, chemicals, by Dilwyn Parrish; a lot of very excellent chemicals, all of which deserve credit. A small bottle of bromine apparently belonging to this lot, but made by E. Gillespie, possesses great interest on account of its novelty as an American manufacture, and its apparent purity.

No. 524, magnesia calcined and fluid, by Thomas J. Husband; the articles look very well, and your committee regret that their time will not allow them to test their purity. The calcined magnesia appears very light, white, and free from grit, or lumps; and if it can be substituted for Henry's, as the manufacturer asserts, will be of great importance. The plaster exhibited by Mr. Husband is not within the province of a chemical committee.

No. 525, three small bottles of chemical preparations, by J. Taylor; the iodide of lead is very beautiful, but the specimen is not large enough; the others are not worthy of note.

No. 532; Edward Pryor exhibits oils of hemp seed and peach kernels, both excellent preparations, but not important unless they can be made cheaper than that imported, of which your committee have not the means of judging.

No. 535, cyanide of potassium, by H. Worthington; a beautiful preparation, and superior in appearance to either of the other specimens of this substance exhibited.

No. 536, chemicals, by Smith & Hodgson; a fine display of beautifully prepared articles, among which the biniodide of mercury, mosaic gold, chromic, and gallic acids, are peculiarly deserving of note.

No. 537, chemicals, by William Procter, jr.; all these preparations are excellent, and several very superior; the committee would advise, however, more attention to extracting the coloring matter, which would add greatly to the beauty of their appearance.

No. 539, Seidlitz powders, &c., by Haskell & Merrick; these are neatly put up; would appear to be very convenient, and will, doubtless, be found very agreeable.

No. 547, a lot of mustard and spices, from the Messrs. Fell; the articles are neatly prepared and well put up, and will be found convenient for family use, but of their peculiar excellencies the committee are not able to judge.

No. 548, chemicals, by Edwin Parrish; they are generally very good specimens of preparation. The tannin is lighter in color than any other specimen shown.

No. 551, chemicals, by Farr, Powers & Weightman; this is decidedly the best lot of chemicals exhibited, and derives increased interest from the fact, that they are manufactured upon a very large scale. The committee would call attention especially to the samples of quinine, calomel, and corrosive sublimate, by two different methods.—These articles are merely the commercial articles of this firm, such as they sell to their ordinary customers, and the committee deem them deserving of the highest approbation.

No. 552, pine oil or camphine, manufactured by Benj. T. Davis; this is a very superior article, entirely colorless and transparent, with comparatively a faint smell, and great purity, as is indicated by its preservation of its properties in open vessels; the committee judge it to be worthy of high praise.

No. 553, a box of beautiful isinglass, by Delacour.

No. 561, a lot of chocolate and cocoa, from the manufactory of G. Schmitz; it looks, smells and tastes well, but the committee cannot go into any nice investigation of its merits.

No. 577, a box of starch, by Altemus; appears to be very white, soft and pure.

No. 580, polishing rouge, by Mrs. West; the article seems to be very good, being well prepared and free from grit; it has a little acidity, which is probably not injurious to its good qualities; it is deserving of praise.

Nos. 502, 522, 549, and 578, perfumery, by Messrs. N. B. Hinton, Hauel, Roussel and A. E. Wetherell. Roussel still maintains a decided superiority in his perfumery over his competitors, although Hauel has very much improved upon his exhibition of last year; the committee, however, regret to see upon his stand bottles of extracts, purporting from the label to have been manufactured in Paris. Such extracts are not proper subjects of exhibition in the Institute, and should have been, in the opinion of your committee, excluded. The judges have taken no notice of them in instituting their comparisons.

Nos. 528 and 564, soap, by Messrs. H. P. & W. C. Taylor and J. R. Graves; these gentlemen exhibit each a beautiful lot of soaps, in the manufacture of which, a decided improvement is very visible. Messrs. Taylors' collection consists entirely of the pure transparent soap, while Mr. Graves exhibits a variety of the article as more usually employed in the arts, and offers them at prices which much enhance the importance of his display. The committee consider both these gentlemen to have deserved the approbation of the Institute,

but they would especially call attention to the articles of Mr. Graves, on account of their apparent excellence, and the low price at which they can be afforded.

In conclusion, the committee recommend the following awards:

No. 551, to Messrs. Farr, Powers & Weightman, for their admirable display of commercial chemicals, A Silver Medal.

No. 536, Smith & Hodgson, for a beautiful display of chemical preparations, A Certificate of Honorable Mention.

No. 518, to Alex. H. Campbell, for the excellence of his prepared spermaceti, A Certificate of Honorable Mention.

No. 549, to Eugene Roussell, for the best perfumery, A Certificate of Honorable Mention.

No. 528, to H. P. & W. C. Taylor, for their transparent soap, A Certificate of Honorable Mention.

No. 564, to J. R. Graves, for very beautiful and cheap soaps, A Certificate of Honorable Mention.

MECHANICS, PHYSICS, AND CHEMISTRY.

Notice of the Manufacture of Glass in Bohemia. By M. L. P. DEBETTE.—[Annales des Mines, 4th series, volume iv, page 553: December, 1843.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Of Glass in General.—Every transparent, or, at least, translucent substance, which is brittle at ordinary temperatures, becomes soft and ductile, and finally melts, at a high temperature, and of which, when cold, the fracture presents a peculiar, well defined lustre, known as the vitreous lustre and the vitreous fracture, is called, in the most general sense of the word, glass. Many acids, such as the phosphoric and boracic, as well as many silicates, phosphates, borates, arseniates, fluorides, and some metallic chlorides, such as those of lead and silver, different mixtures of these bodies with each other, and with other substances, among which the alkalies and the earths hold the first place, give glasses by their fusion. That which in the arts is more especially meant by the term glass, is a compound of silica, potassa, or soda, or both together, and of lime and oxide of lead alone, or mixed. This compound gives, by fusion, an amorphous and transparent mass, which is not soluble in water, nor in any acid except the hydro-fluoric.

History.—According to Pliny, the discovery of glass is due to some Phœnician travelers, who having, by accident, used a block of natron, (the native salt of soda,) in arranging their fire in the desert, saw, with astonishment, the two substances combine by fusion, and give a glass; but this fact cannot be admitted, the temperature required being far higher than could be obtained under such circumstances. M. Handiequer de Blancourt, one of the oldest French writers upon the

subject of glass, carries the invention back as far as Tubal-Cain, because he having discovered the art of working metals, by fusion, must have obtained slags analogous to glass.

At all events, it is certain that the discovery is very ancient, for it is mentioned in the Holy Scriptures, first, in the Book of Job, chapter xxviii, verse 17, where it is written,—"The gold and the crystal* cannot equal it," &c. And secondly, in the Book of Proverbs, chapter xxiii, verse 31,—"Look not thou upon the wine when it is red; when it giveth this color in the cup,†" &c. Aristotle, in a work written in the year 384 B. C., speaks of glass, and seeks to explain its transparence. Fourteen years later, in 370, Theophrastus mentions the glass works situated at the mouth of the river Belus; which is nothing astonishing, for the Phœnicians were the most skilful in the arts of all the people of antiquity, and had, so to speak, the necessary sand and soda under their hands.

The Egyptians were also, from the most remote antiquity, acquainted with the art of making clear and colored glasses, of cutting and of gilding them, as is proved by the glass dresses found upon several mummies from the catacombs of Thebes and Memphis. At a later period, under the Emperors, glass works were erected near Alexandria, which became very celebrated, and filled Italy with their productions.

The Romans were acquainted with glass more than two centuries before Christ; but it was as late as the reign of Nero, that the first glass works was established at Rome; and even then they made only poor drinking glasses. The fine glasses were still so dear at this time, that the Emperor Nero paid more than four thousand francs of our money (eight hundred dollars,) for two handsome glass cups. Under Alexander Severus, A. D. 210, the number of glass workers had so much increased at Rome, that it was thought proper to assign to them a particular quarter of the city.

In the middle ages, Venice distinguished itself by its glass works, which, in 1291, were transferred to the peninsula of Murano, the name of which soon became famous. In this place, it is said, the first blown glass was made.

At this period Bohemia was the most skilful and the richest country in Germany, to which it gave its emperors. Its relations and commerce with Venice and Italy soon introduced into it the art of glass making, and the extreme purity of the raw materials, which are met with in abundance in the mountains which form a girdle around this country, soon assigned to it, in this art, a superiority and reputation which have been maintained to this time.

Traveling, in 1842, through Bohemia, I visited with interest the most renowned manufactures of glass and crystal, and especially the various groups of the Böhmerwaldgebirge. The beauty of the productions of these workshops, and the veil which still covers their pro-

* The word which in our version is translated 'crystal,' is rendered in the Vulgate 'vitrum,' glass.—TRANS.

† Here again the word rendered 'cup,' in the English, is given as 'vitrum,' or glass, in the Vulgate.—TRANS.

cesses of manufacture, have induced me to publish here the few observations which it has been in my power to make.

The extent of the work compels me to divide it into fifteen chapters, in which I shall treat successively—

Chapter I.—Of the composition and properties of glass.

Chapter II.—Of the choice and preparation of the raw material.

Chapter III.—Of the glass works of Bohemia generally.

Chapter IV.—Of the manufacture of table glass, (verre de gobeletterie) and that of the fine glass called Bohemian crystal.

Chapter V.—Of the manufacture of bottle glass.

Chapter VI.—Of the manufacture of window glass.

Chapter VII.—Of some particular articles made of glass.

Chapter VIII.—Of colored glass.

Chapter IX.—Of opalescent glass.

Chapter X.—Of hyalite.

Chapter XI.—Of the manufacture of enamelled cast vessels.

Chapter XII.—Of the art of cutting glass.

Chapter XIII —Of the art of gilding, silvering, platinizing, and incrusting glass.

Chapter XIV.—Of the manufacture of mirrors.

Chapter XV.—A general statistical view of the glass works of Bohemia.

Chapter I.—*The Composition and Properties of Glass.*

Glasses are silicates which must contain at least fifty per cent. of silica; the more there is of it, the more perfect, unalterable, hard, and infusible is the glass. The hardest, most beautiful, and most perfect glass is found in nature in the state of pure silica in rock crystal; but as this is fusible only at the highest temperatures which can be produced in our laboratories, such as those produced by employing Newmann's* blowpipe, or by the aid of a galvanic, or electrical, battery, it is impossible to procure it artificially. To render silica fusible, certain fluxes must be added; these fluxes are potassa, soda, lime, and oxide of lead.

Silica fuses very well with the alkalies, but the resulting glass is rapidly changed by absorbing moisture from the air. To prevent this alteration, it is always necessary, in the manufacture of glass, to introduce a certain quantity of lime, or of oxide of lead.

In the following table is given the analysis of a certain number of Bohemian glasses, which will indicate their composition with precision.

* This is one of the thousand European modifications of Hare's compound oxyhydrogen blowpipe, every one of which is as inferior in power, as in simplicity, to the original.—Trans.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Silica,	71.6	71.7	69.4	62.8	75.9	78.85	70.	57.
Potassa,	11.	12.7	11.8	22.1	"	5.5	20.	25.
Soda,		2.3			17.5	12.05		
Lime,	10.	10.3	9.2	12.5	3.8	5.6	4.	12.5
Magnesia,	2.3							
Alumina,	2.2	0.4	9.6	2.6	2.8	3.5	5.	3.
Oxide of Iron,	3.9	0.3					0.6	1.3
Oxide of Manganese,	0.2	0.2					0.4	0.4
	101.2	98.1	100.	100.	100.	100.5	100.	99.2

(1) Bohemian glass from Neufeld; (M. Gras,) its composition is represented nearly, by the formula $Ca.S^5 + (Al.F)S^3 + (K.Mg.Mn)S^3$.*

(2) A fine table glass from Neuwelt, (M. Berthier;) it is exceedingly beautiful, and is prepared, according to M. Perdonnet, with a mixture of 100 quartz, 50 caustic lime, 75 carbonate of potassa, and a very small quantity of nitre, arsenious acid, and oxide of manganese. The presence of arsenic cannot be detected by analysis. The composition of this glass is expressed by the formula $C.S^6 + (KN)S^6$.

(3) Old Bohemian glass (M. Dumas;) its formula is $(Al.C.K)S^4$.

(4) Crown glass of German manufacture (M. Dumas;) its composition is expressed by the formula $(K.C)S^4$.

(5) Glass for mirrors (M. Dumas;) it is represented by the formula $(N.Al.C)S^6$.

(6) Another glass for mirrors (M. Dumas;) its formula lies between $B.S^5$, and $B.S^6$.

(7) White table glass from Silberberg near Gratzen; its composition is exactly expressed by the formula $2(K.Ca)S^5 + (Al.F)S^5$.

(8) Mirror glass from Neu-Hurkenthal, for the manufacture of cast mirrors. It shows a greenish tint in section, and softens at a gentle heat. Its composition is nearly represented by the formula $(Al.F)S^3 + 6(K.C.M)S^3$, or more simply $(K.C.Al)S^3$.

I shall give the composition of the mixtures which are introduced into the pots, when I come to describe the manufacture of each kind of glass.

Properties of Glass, Transparence, Colorlessness.—Transparence, and colorlessness are the first properties of glass; to obtain them, the materials must be employed extremely pure, and the least possible flux added; an excess of potassa gives to glass a greenish tint; soda and its salts gives it a yellow tint, and lime renders it milky. A very small quantity of the sulphate of potassa, or soda, gives it a yellowish, or blackish, brown green; iron colors it strongly bottle green, and an excess of the manganese employed to remove the coloration due to oxide of iron, gives it a bluish tint, which becomes a decided violet by the action of the solar light. If the minium employed in the manufacture of crystal contains a little copper, which very often happens,

* The reader will remember that these are mineralogical, and not chemical, symbols; hence the letters signify the oxides, or acids, and not the elementary bases, as they would in chemistry.—Trans.

the crystal takes a slight emerald green tint; this, however, is not to be feared in Bohemia, where there is but a single establishment which makes lead glass.

Charcoal colors glass of a topaz yellow, more, or less, dark, and sometimes reaching a purple, so that it is impossible to obtain a perfectly colorless glass in furnaces which smoke, or in those which are heated by turf, lignite, or bituminous coal; and in these cases it is necessary to employ covered crucibles, as is done in the manufactory of crystal at Choisy le-Roi; it is also necessary, on this account, when in the fabrication of glass the alkaline carbonates are replaced by sulphate of soda, to add, in the crucibles a little (about one-thirteenth,) less of carbon than would be necessary to reduce the sulphate completely, and even thus but common glass is obtained by this process, since the slight excess of sulphate of soda, which must be left, gives a blackish brown tint.

Hardness, Elasticity.—The Bohemian glass is within certain limits perfectly elastic, and very sonorous; when well made it is sufficiently hard to strike fire with steel, and is scratched with difficulty. The lead glasses, on the other hand, have but little hardness, and less in proportion as they contain more oxide of lead; besides which they rapidly lose their brilliancy by use.

Fusibility, Cooling, Annealing, Devitrification.—All glass is more, or less, fusible; when it is softened by the action of heat, it may be worked with the greatest ease, and may be drawn out into threads as fine as those of the cocoon of the silk worm. Glass, when it is submitted to rapid cooling, becomes very fragile, and presents several remarkable phenomena, among which I will cite as an example Prince Rupert's drops. Glass supports variations of temperatures better in proportion as it has been more slowly cooled; thus when they have been but slightly annealed, or not at all, their fragility may be considerably diminished by annealing them in water, or, better, in boiling oil.

All glass exposed during a longer, or shorter, time to a heat sufficiently elevated, loses its transparency, and becomes extremely hard, and much less brittle than before. There takes place a phenomenon precisely similar to that which we see taking place every day by the slow cooling of the slags of our smelting furnaces, and especially in volcanic lavas. Glass with a soda base is more fusible and less hard than that whose base is potassa.

Density.—Below is given the densities of several glasses without lead:—

Old Bohemian glass (Dumas,) . .	2.396
Bohemian bottle glass, . .	3.782
Bohemian window glass, . .	2.642
Fine glass called Bohemian crystal, .	2.892
Mirror glass of Cherbourg, (Dumas,) .	2.506
" St. Gobain, " .	2.488
" Neuhaus, 1812, (Scholz,) .	2.551
" " 1830, "	2.563

Action of Atmospheric and Chemical Agents.—The harder and

more infusible a glass is, the less is it alterable by the action of atmospheric and chemical agents, with the exception of hydrofluoric acid. Glass, which is too alkaline, attracts gradually the moisture of the air, and loses its lustre and polish. Many glasses are perceptibly attacked by a prolonged boiling with water, and *a fortiori* by acid and alkaline solutions; thus the bottle glass is frequently attacked by the tartar which is found in the wine. According to Guyton Morveau, all glass which is attacked by prolonged boiling with concentrated solutions of alum, common salt, sulphuric acid, or potassa, is of bad quality.

CHAPTER II.—*Of the Choice and Preparation of the Raw Material.*

The silica which is employed in Bohemia in the manufacture of glass, is obtained by calcining crystaline quartz, and afterwards pounding it while dry. The quartz is sometimes found in veins in granite and gneiss, as at Neu-Hurkenthal; but it is more frequently met with, either under the form of rolled pebbles in the torrents of Böhmerwaldgebirge, or in fragments, more or less angular, scattered through the vegetable earth, which comes from the decomposition of the primitive rocks. It is evident that these fragments are the remains of the quartzose veins, which, presenting a greater resistance, have escaped the disintegration of the granite or gneiss which enclosed them, and which have been more or less rolled in their transportation.

Those of these fragments which appear to the eye exempt from metallic matters, are bought and sent to the glass works, at the mean price of 0.65 francs per 100 kil: (6.6 cts. per cwt.) These fragments are roughly assorted at the manufactory; those of smoky quartz, called topazkies by the inhabitants, are laid aside as the purest, and reserved for the manufacture of glass of the finest quality, or crystal.

The quartz is calcined, either in reverberatory furnaces or in furnaces of a peculiar form, shown in the plate which accompanies this notice.

When the quartz has been heated to a cherry red, it is withdrawn from the fire, and thrown immediately into a large and shallow tub, the water of which may be continually renewed by a stop-cock, and its heating thus prevented: the quartz thus calcined and cooled, is picked out by hand by women, who gain 0.4 francs (8 cents) for 12 hours work. The fragments which are too large and too hard, which have not been sufficiently calcined, are broken into pieces and thrown back into the furnace: the rest is broken up into small fragments, and those parts which are perfectly white, are alone employed in the manufacture of glass. All fragments which present the least trace of metallic oxides, (ordinarily oxide of iron) are separated with the greatest care, pulverized separately, and employed upon iron wheels in grinding the cut glass.

Upon an average, 0.07 steies of pine wood is consumed in calcining 100 kils. of quartz, (1¼ cubic feet per cwt.) The quartz, after being calcined and picked out, is then pounded while dry—the pestles are armed with cast-iron heads, the weight of which varies from 120 to

150 kil: (264 to 330 lbs. av.) their play is from .5 met. to .6 met., (1.64 to 1.99 ft.) and each of them falls into a hemispherical mortar, about 10 in. in diameter, cut in a large beam which extends throughout the length of the pounding machine. The use of iron and stone mortars had to be rejected on account of the fear that the head of the pestles might detach sufficient ferruginous particles to diminish perceptibly the purity of the glass.

The powder obtained from the pounding machine is sifted, and that which remains upon the sieve is pounded over. Each pestle of the pounding machine pulverizes in 12 hours 90 lbs. of quartz.

Potash.—Almost all the Bohemian glass is potash-glass; because soda and its salts give to glass a sensible yellowish tint, and because the difference of the price of potash and soda is far less in Bohemia than in most of the countries in Europe. A small quantity of the potash used in Bohemia is made in that country; but the greater part is drawn from Hungary. There the Carpathians are covered by immense forests, the greater number of which are, in the present condition of things, unavailable, on account of the low price of fuel, and the difficulty of communication. They are, therefore, put to use by burning them standing, and withdrawing the common potash from their ashes by washing.

To obtain potash of the second quality, the preceding is treated cold by its own weight of water, then decanted; the decanted liquor evaporated to dryness, and the potash thus obtained, calcined at a heat high enough to frit it.

Finally, to obtain the finest potash, or that of the first quality, treat the potash of the second quality as before, using only one half of its weight of cold water.

It is of the greatest importance that the trees which have furnished the potash, shall not have grown upon a metalliferous soil, that is a soil perceptibly charged with metallic oxides and salts, for we know that these substances are absorbed by the sap, and that we can even imitate artificially by this process, a great number of colored woods, by causing certain metallic solutions to be successfully absorbed by woods of analogous structure and tissue.

When this is the case, the potash which is obtained by washing the ashes of the trees, although it may appear very pure at first sight, contains almost always, a sufficient quantity of metallic oxides to color the glass perceptibly, which must cause it to be rejected in the manufacture of fine glass. This remark, and the recollection that the value of the Bohemian glass depends peculiarly upon its perfect colorlessness, have caused the adoption in this country, of a process of testing, altogether different from the alkalimetic processes employed in France, which give only the amount of alkali, without at all indicating the nature and proportion of the foreign and injurious materials which it may contain. This test, which is still farther facilitated by the small size of the glass-pots, which in Bohemia do not contain more than from 120 to 200 lbs. of calcined and fritted materials, is performed by replacing in one of the pots in which fine glass is made, the potash ordinarily employed, by its weight of the potash to be tested, and

comparing the articles made with the glass obtained, with glasses of known composition, made once for all, by varying the quality and quantity of the alkali.

Thus, by the perfect whiteness, or by the more or less decided shade of color of the glass obtained, the nature and proportion of the metallic impurities, and even, approximately, the alkaline contents of the potash tested, are ascertained; and thus its commercial value can be directly obtained.

In the mines of the Böhmerwaldgebirge, the prices of the different kinds of potash, per cwt., are as follows:

For common potash,	(third quality)	- - -	$4 69
Fine "	(second quality)	- - -	5 61
Superfine "	(first quality)	- - -	6 97

Soda.—Soda is, as I have before remarked, but little employed in Bohemia, where it is used only in the manufacture of common window glass. Common soda costs $3.74 per cwt.

Sulphate of Soda.—The sulphate of soda, or glauber salts, is obtained in chemical works as a residue from the manufacture of nitric acid, by means of nitrate of soda and sulphuric acid, and it is employed only in certain glass works annexed to these establishments, (as at Gross-Luckawitz, near Chrudim,) where they make the bottle-glass retorts and matrasses used in the works themselves. (1-13 of its weight of carbon must be added.)

Lime.—The lime employed in the glass works of the Böhmerwaldgebirge, is obtained from a saccharoidal limestone, found both in Moravia and in Bohemia, (near Winterberg,) in beds enclosed in gneiss, which shews the same stratification; whilst in certain places, and especially near Winterberg, the granite upon which these beds rest, may be seen to send forth veins into them. This fact appears to demonstrate in a clear manner, that this limestone and gneiss, which are regarded as primitive by many German geologists, and among others by Professor Zippe, of Prague, are the effect of a metamorphosis due to the appearance of the granite, which has elevated the chain of the Böhmerwaldgebirge.

This saccharoidal limestone is perfectly white, and presents two extreme varieties; one of which, with broad plates and very transparent, imitates to deception, the most beautiful ancient statuary marble, (such as that of Paros,) while the other, with an extremely fine and close grain, has a greater analogy with the Carrara marble.

These limestones are calcined in the same furnaces which serve to burn the quartz, and are then suffered to slack spontaneously in the air, and care is taken to frit again the powder thus obtained, before placing it in the crucibles of the glass furnace. In the mixture, from 6 to 20 parts of calcined lime are introduced for 100 parts of silica.

Peroxide of Manganese.—The peroxide of manganese is but little employed in Bohemia, at least in the manufacture of fine glass: it serves to destroy the bottle-green color due to the protoxide of iron.

Arsenic.—The arsenic is obtained in the state of arsenious acid, from the Erzgebirge and from the Riesengebirge, where it is obtained,

both as a principal product of the roasting of arsenical pyrites, and as an accessory product of the roasting of ores of tin and cobalt. It is much employed in Bohemia, especially in the manufacture of fine glass. It serves, first, to destroy the greenish tint due to a small quantity of the protoxide of iron; secondly, to destroy the topaz yellow color which the glass assumes if the furnace smokes, or if the wood in crackling should throw small sparks of charcoal into it; and thirdly, it serves to agitate the melted matter and assist the disengagement of bubbles.

Nitrate of Potassa.—Saltpetre, or nitrate of potassa, is employed in some of the establishments, together with white arsenic, to produce the same effects.

The pieces broken off in grinding, old broken glasses, glass which has been spilled upon the hearth of the furnace by an accidental fracture of the glass-pots, &c., are broken up, washed and classed according to their nature, their color and purity, and commonly employed in the manufacture of common glass. The pieces from making the fine glass alone, are used in the manufacture of white table glass.

Combustibles.—The combustible used in the glass works of Bohemia, is resinous wood, of which the prevailing species is the *kiefer*, (pinus sylvestris); this species is also the best for working glass, because it crackles least in the fire, and gives the most flame. The flanks and summits of all the mountains which form the chain of the Böhmerwald and Reisengebirge, are covered with forests of resinous woods. These forests are cut when of full growth, about every 80 or 100 years. The wood is cut during the summer, then in winter it is transported to the water courses which wind through the valleys, by means of slides made in the snow, and when these melt it is floated down to the glass works. The mean price when delivered at the establishments, throughout the whole of the Bömerwaldegebirge, is 23 cts. per cubic yard. The wood is completely dried and even slightly roasted before it is used, in cast iron boxes, heated externally by the flames which escape from the glass furnaces. I have seen but the five glass works of the Count de Buquoi, where this process has been abandoned for some fifteen years, and I do not know the motive of its disuse.

By the preliminary roasting of the wood, an economy of ten per cent. in the fuel is gained; and besides, the fire becomes much more easily regulated.

Clay for the Crucibles.—The clay employed in the manufacture of the crucibles, in the glass works to the east of the Bömerwaldgebirge, comes from Moravia; that employed in the glass works situated in the western part of that chain, is taken partly from the environs of Pilsen, in Bohemia, partly from the neighborhood of Nuremberg, in Franconia.

These clays are very white, very aluminous and but slightly adhesive; by calcination they lose nothing of their original whiteness. A specimen of the clay from Moravia, employed at *Silberberg*, in the manufacture of glass pots, gave by analysis, the following results:

Silica,	45.8,	Oxygen,	23.8,	Ratio,	2
Alumina,	40.4,	"	11.4	"	1
Water,	13.8,	"	12.1	"	1
	100.0				

Which gives for its formula $AS^2 + Aq.$, which represents Triklasite or Fahlunite. Except that this clay contains no combustible matter, it presents in its composition a very great analogy with the refractory clays of Stourbridge and Stannington, the analysis of which has been given by M. Play, (Annales des Mines, 4th series, vol.III, p. 646) in a very remarkable memoir upon the manufacture of steel in Yorkshire.

Chapter III.—*Of the Glass Works of Bohemia generally.*

On the Situation and Composition of the Glass Works.—The principal thing to be considered in the location of glass works being the facility of procuring fuel, they seek as much as possible to establish them in the midst of forests, and upon the banks of a water course which will allow the floating of the wood to them, and upon which may be also established, at no great distance, the stamping machines, and the mills for cutting the glass, (schleifer mühle,) which are almost always driven by a water-wheel. The power of the stream of water is increased, when necessary, by putting it into communication, by means of sluice-gates, with the small pools which are met with in such quantity among the mountains. As the forests can be cut only about once in a century, it is often advantageous, after having cut off all the wood in the neighborhood of an establishment, to transfer it, for a certain time, to another place, where a supply can be more easily found, until this, in its turn, also becomes exhausted. This instability in the location of the greater part of the works, has, from motives of economy, led them to construct the buildings which enclose the furnaces entirely of wood; so that, at first sight, nothing is more miserable than the appearance of these works, which seem lost in the midst of endless forests, and which show themselves from afar off by the clouds of smoke which rise above the trees. It is only those works which are certain of what may be called an indefinite supply, such as those of MM. Meyer, situated near Moldau, which are, in part, constructed of stone.

The glass works of Bohemia are generally composed of two melting furnaces (schmelzöfen, or glasöfen,) one of which is in action, while the other is undergoing repair, so that one is always in activity.

When the establishment makes window glass, it has besides one or two furnaces (flattening kilns) to flatten the glass (strecköfen) which are placed under a separate shed attached to the works.

The store house for the raw materials is also attached to the works. The stamping machine and the furnaces for calcining the quartz and the lime, are also attached to the works whenever the stream is of sufficient power to allow it, but generally they are separate and placed at some distance either above, or below; the same arrangement is

made of the shops in which the table glass and Bohemian crystal is cut, to which is also annexed the store house for the finished glass.

Melting Furnaces.—As the beauty and quality of the glass, other things being equal, depends particularly upon their perfect fusion, which takes place only at a very elevated temperature, not to be obtained except by a particular arrangement of the melting furnace, *(schmelzöfen,)* this becomes the most important part of the establishment. This furnace should be so constructed, that, 1st. A suitable and sufficiently elevated temperature may be produced; 2d. That the flame may circulate freely around the glass pots; 3d. So that the greatest useful effect may be obtained with the smallest quantity of fuel.

These conditions have led to the adoption of peculiar furnaces of an elliptical form, furnished with shelves on which the glass pots are placed. These furnaces are all nearly of the same form; but their dimensions are somewhat variable with the number and size of the pots; they hold 7 or 8. The fire-bricks which are used in the construction of these furnaces, are formed of two parts by volume of fire-clay mixed with one part of the fragments of glass pots, picked and powdered. The vault is always made of a single piece of clay.

Annealing Furnaces.—These furnaces are always accompanied by a kühlofen, or furnace for annealing the glass heated by means of the flame which escapes from the melting furnace. The annealing furnace is almost always surmounted by an apparatus for drying the wood, which is composed of four cubic boxes of cast-iron, 2.89 feet on each side, exposed on five of their sides to the flames which come from the annealing furnace by four apertures, and afterwards escape from the apertures by a single opening in the upper part.

The operation is conducted far too rapidly, for a complete drying, and even an incipient roasting of the wood is obtained in the course of one and a-half, or at the most, two hours; and it would be evidently very advantageous to slacken it by furnishing the openings which communicate with the annealing furnace with movable registers.

The length of the season is, upon an average, twenty-eight weeks, or six months.

Glass Pots.—The glass pots (hafen) used in Bavaria, are circular, and made with the greatest care; they are of two dimensions, and have no rims.

The smallest receive a charge of from 140 to 165 lbs. of fritted materials, and are used in the manufacture of fine glass, and table glass. Their dimensions are as follows:—

Internal diameter,	above . .	1.28 feet.
	below . . .	1.11 "
External "	above . . .	1.47 "
	below . . .	1.38 "
Depth, ...		1.44 "
Thickness at bottom, ...		1.57 inches.

The large pots receive a charge of about 220 lbs. avp., and are used in making window and bottle glass; their dimensions are as follows:—

Internal diameter,	at the mouth, . .	1.41 feet.
	at bottom, . .	1.25 "
External "	at the mouth, . .	1.67 "
	at bottom, . .	1.57 "
Depth, ...		1.7 "
Thickness at bottom, . . .		1.87 inches.

The paste of which these pots are made is composed of a mixture of very aluminous fire-clay, of which I have given the analysis above, and of very pure quartz pulverized in a dry state; sometimes they employ, as a cement, the remains of old glass pots broken up and picked, and then pulverized. After kneading the paste with the feet, in order to make the mixture as thorough as possible, the pots are formed by means of a small wooden beater, and a mould also of wood, which allows the workmen to give them accurately the same exterior dimensions. These crucibles last very differently; at Swartzthal, they last, upon an average, six weeks; at Silberberg, Winterberg, Leonorenhain, about twelve, or sixteen, weeks, and sometimes more. These crucibles after having been sufficiently dried in the air, are baked in the annealing furnaces, or very rarely in a separate furnace. When a change is necessary, they introduce them during the working season, by one of the embrasures which is made of sufficient size for this purpose, and larger than the others. Of course the new crucibles are brought up to a white heat before being placed upon the furnace shelf.

The analysis of a selected fragment of the glass pots used at Silberberg, gave me--

Silica,	61.0	Oxygen,	31.7	Ratio, 3
Alumina,	39.0	"	10.8	" 1
Oxide of tron, a trace.				
	100.			

Very white particles, which appeared to be small grains of quartz, could be seen with the naked eye in the paste.

Another Bohemian glass pot, whose locality is unknown, gave M. Berthier, upon analysis,—

Silica,	68.0	Oxygen,	35.4	Ratio, 4
Alumina,	29.0	"	8.1	
Oxide of iron,	2.2	"	.6	9. 1
Magnesia,	0.5	"	.3	
	99.7			

By use the substance had become excessively hard, of a light gray, and was filled with an infinity of small globular cavities, which indicated a commencement of fusion, and presented besides a multitude of small very white grains, which showed themselves very plainly upon the grey ground of the mass.

Flattening Kilns.—These kilns are either isolated or placed together two by two; I have been informed that there are some placed together in fours. They are always composed of a flattening kiln, (strecköfen) into which the flame comes from the fire-place by four small chim-

neys, placed at the end of the bottom of the kiln, and which communicate with an annealing furnace, into which the flame passes from the fire-place by a single opening only.

Of the Persons Employed.—The persons employed in a glass works consist, 1st. Of a director, (buchhatter) who superintends the works, keeps the books, receives orders, forwards the goods, pays the workmen, &c.

2d. Of the workmen employed in transporting and preparing the raw materials.

3d. Of women who are employed to pack the finished goods.

4th. Of workmen employed in transporting the goods.

5th. Of workmen employed in the making and cutting of the glass. Among these are the firemen, the glass-blowers and glass-cutters.

The regulation of the fire requires two firemen for each furnace, who relieve each other in turn, so that there is always one at the furnace. They receive each $1.30 per week, or about 20 cts. per day.

Each glass-pot is tended by one blower, aided by his apprentice, who brings the moulds, removes the finished pieces, &c. The pay of the blowers, as well as that of the cutters, is 9½ cents per *shock* of glass worked. The number of pieces which form a shock, varies according to their nature, and the rate is so arranged, that a good workman may easily gain $1 in 12 or 15 hours work.

Besides this, in the establishments in which the above tariff is established, they are in the habit of giving to the workmen, so long as they are engaged in the works, a wooden cottage to live in, and a kitchen garden of sufficient size for their use, and to permit them to keep a cow, without being subject for these, to any extra labor or manorial dues; so that it is extremely difficult to fix, in a precise manner, the real pay of the workmen, and of course, the cost of the glass.

Of the Expense for Fuel.—I shall give here the annual consumption of fuel in each establishment, supposing it to consist, as is usually the case, of two melting furnaces, the working and repair of which succeed each other, so that there is always one in action.

In the glass works of the Count of Buquoi, where they use dry wood not roasted, they consume annually 1255 cords of wood (160706 cubic feet,) when they are making table glass, or fine glass, as at Silberberg, and 1507 cords (192847 cubic feet,) in making window glass, as at Schwarzthal, the increase arising from the fact that the glass pots there are rather larger, and the time of working being smaller, a greater number of meltings are made per week.

In the establishments of MM. Meyer, at Winterberg and Leonorenhain, where the wood is slightly roasted before employing it to heat the glass furnaces, they consume annually 1130 cords (144812 cubic feet,) in making table glass, and fine glass, which gives an economy of $\frac{1}{10}$ over the consumption at Silberberg. This great economy of fuel is evidently due to the fact, that a certain quantity of heat is necessary to drive out the hygrometric moisture of the wood, and to vaporize it entirely, and that in Silberberg this heat is taken from that developed in the melting furnace, while in the works of MM. Meyer,

as in those which we shall hereafter mention, it is taken from the flames which escape from that furnace. At Goldbrünn, Stachau, and Vogelfanghütte, there is consumed 40.2 cub. ft. per day, or 1143 cords per year, (146578 cub. ft.,) a result which accords in a remarkable manner with that obtained from the works of Winterberg and Leonorenhain. To be Continued.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Mathematico-Physical Class of the Royal Bavarian Academy of Sciences, at Munich.—Translated by Dr. H. Scholl.

A *prize of one hundred ducats* is promised to the successful competitor, for a prize essay on the following subject,—the *Atomic Weights of Sulphur, Iron, and Copper*, are to be stated *in unities of Oxygen*, so that each of these atomic weights be derived exclusively from all the combinations with the other elements mentioned. A sufficiently large number of individual observations is to be made according to every method, in order to obtain a tolerably sure average value, and to find the variation of every experiment from the mean. All the results of weighings are to be reduced according to the method and table of Bessel, to the weight in the vacuum. From all the different series of observations are to be deduced, regard being paid to the relative value of the different methods, the most probable values of the elements mentioned, together with the limits of certainty of their determination according to the method of the least squares. The observations are to be communicated in their original form, so that every number that has an influence upon the result, may be traced back to the original setting down of the experiment.

The reasons that have induced the Academy to the proposition of the foregoing subject, are the following: In calculating chemical analyses by atomic weights, principally in examining organic substances, it happens frequently that the difference between the calculation and the observation is greater than could have been presumed from the accuracy with which the observation had been made. In complicated combinations, by atomic weights, doubts even may remain whether the one numerical ratio, or the other next to it, comes up closer to the observation. This difference arises in part from errors committed in the experiment, in part also from the uncertainty of the determinations of the atomic weights. The uncertainty of the different atomic weights, however, being itself varying, and increasing with their number in the combinations, may have great influence on the result, though the error in the determination of the simple atom be but very slight.

In order to enable us, therefore, to distinguish what share the determination of the atomic weights may have in the difference between the calculation and the observation, and to see whether the analysis is included within this and its own uncertainty, it is requisite not only to have an accurate knowledge of the atomic weights themselves, but to know also how far their determinations may possibly deviate from truth.

The atomic weights have indeed been derived from a great number of observations, part of which had been made with great care, and very considerable improvements in their determination might be obtained, if, from all the observations made, those values were derived by calculation, that approach the nearest to all the experiments; yet the different methods of determination rest on observations of too unequal value to allow us to expect an entirely satisfactory result from the result of this important work.

This it is which has induced the Academy to set a prize on the making of new and most accurate possible determinations, in order to lay thereby the foundation for a thorough and comprehensive establishment of the atomic weights, and of the limits of their certainty. The four elements mentioned have been chosen in preference to others partly on account of their being frequently used, and capable of useful application, partly because two of them enter mutually into different fixed combinations, and may furnish, therefore, different series of equations of condition. The atomic weights forming, moreover, immutable proportions in nature, it needs no farther explanation of the scientific value of their most thorough possible examination.

Competitors for the prize have to send in their essays, written in either German, French, or Latin, and provided with a motto, and a sealed note containing the author's name, before November the 1st, 1845, to the Royal Academy of Sciences, at Munich. The decision as to which of the essays sent in, the prize shall be due to, will be given in the public session of the Academy, March 28th, 1846.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Regulation of Paper Machines.

It is found in practice to be difficult to regulate the motion of the Foudrinier, and other machines, in common use, for the manufacture of endless paper. When the flow of pulp upon any machine is uniform, an acceleration of its motion will make the paper *thin*, whilst a retardation will make it *thick*. Hence it is of the utmost importance, in order to make paper of even weight and thickness, that when the flow of the pulp is uniform, the machine shall move uniformly at the same speed. But if, by any contrivance, the flow of the pulp could be augmented, or checked, just in the same proportion as the machine moves slower, or faster, it is evident that the necessary relation between its speed, and the quantity of pulp thrown on, might be effected and maintained. Consequently, two modes of obtaining the requisite uniformity in the thickness and weight of the endless sheet of paper suggest themselves.

I. To regulate the speed of the motor driving the machine.

II. To regulate the flow of pulp upon the machine.

The attention of constructors has usually been directed chiefly to the first method; and hence we find the machine wheels of paper mills are very frequently *tub-wheels*, wasting a large amount of water, but nevertheless selected and used on account of the regularity of

their motion. With this object also it is almost invariably the practice here, to employ an independent wheel to drive the paper machine alone.

Some attempts have recently been made in this country to regulate endless paper machines by the second method, and accordingly "*pulp regulators*" have been applied with considerable success in several important mills.

It being, in fact, a desideratum to procure some unobjectionable means of effecting the regulation referred to, we have translated below, for the benefit of our readers, from J. B. Viollet's "Journal des Usines," *(Journal of the Workshop,)* an account of a mechanical contrivance devised in France for this object. COM. PUB.

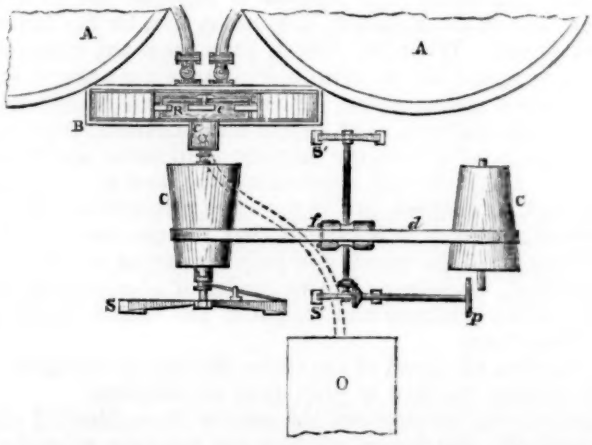
Regulator for feeding machines making Endless Paper: by Messrs. SANDFORD, and VARRALL, *Mechanical Engineers of Paris.**

Whatever care may be taken to render uniform the speed of the motors which drive endless paper machines, and notwithstanding we usually establish for each of these machines a separate water-wheel, constructed of iron, in the best provided works, it has long been impossible to obtain a regularity of motion, and a harmony between the movement of the endless cloth, and the feeding on of the pulp, so that the paper may possess uniformly the same thickness.

From this resulted a serious imperfection, consisting of a marked inequality between the different parts of the long band of paper, and, consequently, between the sheets into which it is cut. We conceived that this inequality was not only a fault, but also that it exposed the manufacturers to disputes not arising from any fault on their part.

In fact, to cause the velocity of the machines, and, consequently, the strength of the paper to vary, it was enough that the resistances op-

Fig. 1.



* These inventors have taken out (April 18th, 1841,) a French patent for ten years, for this eminently useful apparatus, which they and their successors, Varrall, Middleton & Elwell, have applied, at the present time, to their fine machines for the manufacture of paper.

posed by the materials were not constant, or that the stream of water happened to be disturbed.

It is to avoid these difficulties and inconveniences that Sandford and Varrall have invented the apparatus represented in figures 1, 2, 3, 4, 5, and 6, of which their successors have had the kindness to allow us to take off the details in their workshops.

Fig. 2.

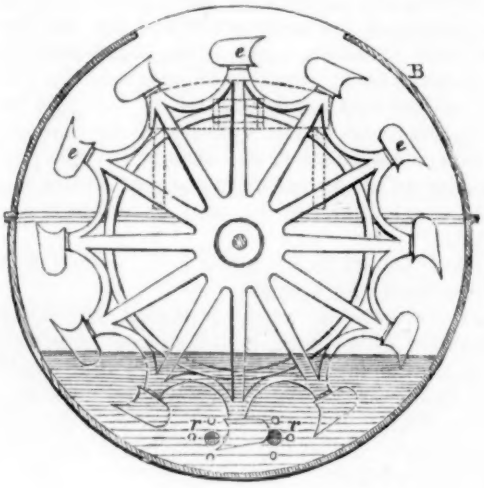


Fig. 4.

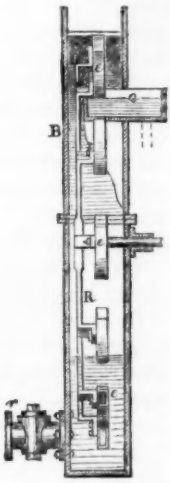


Fig. 3.

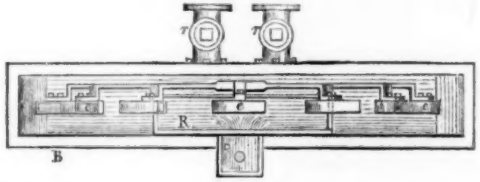
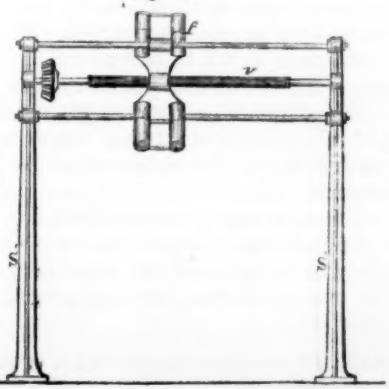


Fig. 5.

Fig. 6.



This apparatus consists principally of a wheel, R, provided with a certain number of scoops, *e*, which take up the diluted pulp, elevate it, and pour it into a receptacle, from which the filter, *c*, conducts it into the vat for working the paper machine. The motion of the wheel, R, being connected both with that of the water-wheel, and of the endless cloth, it is easy to see that if the receiver accelerates, or retards its motion, in consequence of some variation in the level, or quantity, of the water above, the rapidity of the revolution of the scoop wheel, R, and the motion of the endless cloth of the machine, will each feel a proportional variation. But as the scoop-wheel for each of its revolutions pours the same quantity of pulp into the filter, *c*, of the machine, it is evident that the feeding on of the pulp will augment, or diminish proportionally to the velocity of translation of the endless cloth, and that, consequently, the strength of the paper ought to be constant, so long as we do not change the ratio between the quantity of pulp furnished, and the distance moved in a given time by the metallic cloth.

This principle established, let us make known the details of the ingenious apparatus of Sandford and Varrall.

R, as we have said, is the regulating wheel, provided with scoops, *e, e, e ;* this wheel is confined in a drum, B, which the pulp enters from the reservoirs, A, A, by the large stop-cocks, *r, r*, kept entirely open, so as to maintain sensibly in the drum, B, the same level as in the reservoirs, A, A. It is of little importance, moreover, if this level be not rigorously equal, nor even if it varies notably in the reservoirs, A, A ; for, provided the pulp arrives in sufficient quantity, and we must take care that it be always so, each of the scoops, every time they issue from the pulp, only withdraws the same quantity of material.*

We easily conceive how advantageous is this property of the apparatus, since, notwithstanding all the variations of level of the liquid pulp in the reservoir, or *stuff chest*, it assures regularity in feeding on the pulp,—a regularity which would often be compromised if made dependent solely on this level.

It is necessary that the relation which exists between the number of revolutions of the scoop-wheel, R, and the velocity of the endless cloth may be varied, when we wish to alter the strength of the paper.

To obtain this effect Sandford and Varrall have controlled the scoop-wheel, R, by the two parallel cones, C, and C', which carry the belt, *d*. The cone, C', receiving its motion from the lateral shaft established along side the paper machine, and on which is all the gearing which moves the endless cloth, and the other movable parts of the machine.

It is sufficient to move the belt laterally, (along the cones,) in order to retard, or accelerate the rotation of the scoop-wheel, without altering the angular velocity of the other movable parts, and thus, consequently, to change the relation in question, and of course the thickness of the paper made.

* The velocity is never so great that the influence of variations in the centrifugal force need be taken into account.

This displacement of the belt, *d*, is effected with great facility, by means of a fork, or shifter, *f*, mounted on a screw, *v*; this screw carried by the standards, S′, S′, is moved through bevel geer by the hand-wheel, *p*, which answers as a handle to manage it. The fork, or shifter, *f*, remains fixed, and, consequently, maintains the belt in the same place always, until we move the hand-wheel, *p*.

This useful apparatus appears to us to be an indispensable adjunct to all paper machines, of which we desire the products to possess with certainty, that uniformity which is so desirable, or rather so necessary.*—*(Journal des Usines.)*

On Coal-Gas. By Thomas Thomson, *M. D., F.R.S. L. and E., M.R.I.A., Regius Professor of Chemistry in the University of Glasgow.*

There are four varieties of coal which have been tried in Great Britain in the manufacture of gas, namely, caking coal, cherry coal, splint coal and cannel coal. Of these the cannel coal, or parret coal as it is called here, yields the best gas; the caking coal, or Newcastle coal, yields the worst, and the cherry and splint, though very different in their appearance, yield an intermediate gas, the quality of which, whether from cherry or splint coal, is nearly the same.

There are three varieties of cannel coal in the neighborhood of Glasgow, named from the localities where they occur, Skaterigg, Lesmahagow and Monkland.

The specific gravity of these varieties of coal is as follows:—

Caking coal . .	1·280	Mr. Richardson.
Cherry coal . .	1·268	...
Splint coal . . .	1·307	...
Skaterigg . . .	1·229	Dr. R. D. Thomson.
Lesmahagow .	1·198	...
Monkland . . .	1·189	...

Besides ashes, these six varieties of coal consist of carbon, hydrogen, azote and oxygen, combined in various proportions according to the coal. I shall here give the composition of each; that of the first three was determined by Mr. Richardson of Newcastle in the laboratory at Giessen; that of the last three in the College laboratory by Dr. R. D. Thomson. The azote is small in quantity, so small that Mr. Richardson did not succeed in determining its exact quantity; but we found no difficulty in coming to very exact conclusions by the process of Will and Varrentrapp.† As the quantity in all our varieties tried varied from 1·48 to 1·75 per cent., I have supposed that the azote in the three varieties determined by Mr. Richardson was the mean of these two quantities, or 1·61 per cent. The following table shows the composition of these coals.

* We cordially agree with M. Viollet, in his commendations of this ingenious and desirable machine, and recommend it to the notice of paper makers in this country. Com. Pub.

† This process was first proposed by Dr. Schafhaeutl, in Phil. Mag. [S. 3. vol. xvi. p. 44.]

	Mr. Richardson.			Dr. R. D. Thomson.		
	Caking coal.	Cherry coal.	Splint coal.	Skaterigg coal.	Lesmahagow coal.	Monkland coal.
Carbon	87·952	83·025	82·924	76·20	76·25	70·02
Hydrogen.	5·239	5·250	5·491	5·44	6·07	5·56
Azote.....	1·610	1·610	1·610	1·75	1·61	1·48
Oxygen.....	3·806	8·566	8·847	14·47	12·26	14·86
Ashes.....	1·393	1·549	1·128	2·14	2·81	8·08
	100·	100·	100·	100·	100·	100·

It will facilitate our conception of the composition of these different coals if we exhibit their condition by empirical formulas representing the atoms of each constituent, the quantity of azote being reckoned one atom: we leave out the ashes, because they have nothing to do with the production of the gas, excepting that they materially influence its quantity.

Caking . . $C_{127} H_{53} Az O_4$
Cherry . . $C_{121} H_{46} Az O_9$
Splint . . . $C_{120} H_{45} Az O_{10}$
Skaterigg . $C_{102} H_{43} Az O_{15}$
Lesmahagow $C_{110} H_{52} Az O_{14}$
Monkland . $C_{111} H_{53} Az O_{18}$

It appears from this table that Newcastle coal contains the most carbon, and Monkland cannel coal the least; while cannel coal contains the most oxygen and Newcastle coal the least; Newcastle coal contains the least hydrogen and cannel coal the most. Now cannel coal yields the best and Newcastle coal the worst gas. This need excite no surprise; carbon not being volatile, it is obvious that if coal contained nothing but carbon it would yield no gas at all. Coal-gas is a mixture of four different gases, most of which are compounds; two are compounds of carbon and hydrogen, one of carbon and oxygen, and the fourth is pure hydrogen. There is no difficulty in conceiving the formation of the gaseous compounds of carbon and hydrogen, but it is not so easy to explain the occurrence of carbonic oxide and hydrogen. These two gases are never entirely wanting; at least I have analyzed above forty specimens of coal-gas from different kinds of coal and from different gas-works without ever failing to find them. I think it probable that they make their appearance towards the end of the process of heating the coal. It is well known that the longer the process of gas making is continued, and the higher the temperature at which the gas is produced, the worse is the gas, and of course the more hydrogen it contains. Is it not possible that coal may contain water; that this water can only be extricated at a high temperature; that its oxygen combines with carbon and forms carbonic oxide, while the hydrogen makes its escape in the gaseous state? If this supposition were true, there ought to be a constant ratio between the volume of carbonic oxide and hydrogen in the coal-

gas; but this not being the case, it is obvious that the supposition cannot be well founded*.

A ton of Lesmahagow coal, when distilled at the usual temperature, yields about (10,080 cubic feet) one-fifth of its weight of gas, two-fifths of coke, and two-fifths of tar, water, &c.

The gas contains about one-fifth of the carbon in the raw coal, two-elevenths of the hydrogen, and two-ninths of the oxygen; about one-half of the carbon remains in the state of coke, so that about two-fifths go to the formation of the naphthalin, naphtha, naphthene, naphthol, &c., which are formed during the distillation.

Nine-elevenths of the hydrogen and seven-ninths of the oxygen go to the formation of water and various other compounds. The ammonia formed amounts to about 1 per cent. of the liquor obtained during the distillation of the coal.

When gas-works were first established the coal was distilled in iron retorts, but it has been found more economical to substitute vessels of stoneware, or rather indeed ovens of fire-brick made air-tight; these I believe are generally superseding the iron retorts.

During the course of last winter I made thirty-five analyses of gas from different gas-works, but most commonly Glasgow gas. The gas which I used was taken from a pipe at some distance from the gas-works, because the gas required to be washed and purified before it was examined. After turning the stop-cock the gas was kindled and allowed to burn for several minutes before I began to collect it. In every case it contained a mixture of common air, which varied in different specimens of gas from 4 per cent. to 28 per cent.; the mean quantity was 12½ per cent. The specimen containing 28 per cent. of common air was brought up from Greenock, and though very great care was taken in packing it, it is possible that at least a portion of this air might have made its way into the bottles during the transit. If we omit this specimen, the average quantity of common air in the Greenock gas was 10½ per cent.; the average quantity in the Glasgow gas was 12⅓ per cent.

I think it most likely that the common air, which forms a constant ingredient in all gas from gas-works that I have examined, had made its way into the pipes, which it must be very difficult to make air-tight; and when the pressure is removed common air will undoubt-

* Mr. John Hart, of this city, states that he made an experiment which appears to explain the appearance of the hydrogen towards the end of the process. "Having conceived the idea many years ago of causing gas to take up an additional dose of carbon, by passing it over red-hot charcoal, he procured a 1½ inch iron pipe, and having charged it with charcoal, he passed it through the furnace below the gas retort, and joined one end with the pipe from the retort and the other to the pipe leading to the condenser; the fire was then applied and the retort charged as usual. After the gas-holder had risen about a foot, he observed the lead pipe leading to the condenser becoming very hot; it soon after gave way and fell to pieces, and the whole of the gas escaped into the air; but it had no longer the yellow silky appearance of gas issuing from a retort; it had become a white vapor, and had also lost the smell. When the charcoal was examined it was found to be covered over with a fine smooth, shining black coat of carbon, which had been deposited on it." Mr. Hart has concluded from this and other facts, that the gas is decomposed by the red-hot coke, and proposes that the coal should be applied in thin layers to the interior surface of the retorts.

edly enter wherever it can find access. The Greenock gas was collected in an apartment very near the gas-works; the Glasgow gas was collected in my laboratory, which may be about a furlong from the gas-works; now the average quantity in the Greenock gas was 10½, and in the Glasgow 12½.

The highest specific gravity of the Glasgow gas was 0·582, and the lowest 0·462; the average was 0·503.

The quantity of olefiant gas in Glasgow gas varied from 11·77 per cent. to 17·83 per cent.; the mean quantity was 13·52 per cent.

I got gas made at Greenock with as much care as possible from each of the three varieties of cannel coal found in the neighborhood of Glasgow, namely, Skaterigg, Lesmahagow and Monkland: the specific gravities of these gases were,

Skaterigg . . 0·497
Lesmahagow 0·560
Monkland . . 0·622

The olefiant gas per cent. contained in each was as follows:—

Glasgow . . . 13·52
Skaterigg . . 14·15
Lesmahagow 16·66
Monkland . . 22·15

Mr. Ritchie, the manager of the Greenock gas works, who prepared these gases, told me that he thought rather too much heat had been applied to the Lesmahagow coal, which, in his opinion, would have somewhat deteriorated the Lesmahagow coal gas.

The mean quantity of carburetted hydrogen gas in the Glasgow coal gas was 60.6 per cent.; the smallest quantity was 47.33, and the largest 79.77; the quantity of this gas in the gases from cannel coal was as follows:—

Skaterigg, . 66.49
Lesmahagow, . 59.94
Monkland, . 48.77

The goodness of these gases is in the order of naming them. It would appear from this, that the smaller the proportion of carburetted hydrogen the better is the gas; the reason is that the olefiant gas increases as the carburretted hydrogen diminishes.

The average quantity of carbonic oxide in Glasgow gas was 12 per cent., the smallest quantity was 6.34 per cent., and the greatest quantity 15 per cent.: the quantity of this gas in the three gases from cannel coal was as follows:—

Skaterigg, . 7.07
Lesmahagow, . 12.00
Monkland, . 11.76

The mean quantity of hydrogen gas in Glasgow gas was 12.44 per cent., the greatest quantity was 22.85 per cent., and the smallest quantity 2.21 per cent.: the quantity in the three gases from cannel coal was as follows:—

Skaterigg, . 12.29

Lesmahagow, 11.46
Monkland, . 17.32

The common method of determining the light emitted by gas during its combustion, is to set fire to a jet of a given height, and issuing from an orifice of a given diameter, and to compare it with the light given out by a wax candle of six in the pound, usually denominated short sixes; an opake body is placed on a sheet of paper, horizontally between the two flames, and it is so placed that the two shadows formed by it are of equal intensity. The distance between this opake body and the flames is measured, and the light emitted by each is as the square of that distance; thus, if the distance between the gas flame and the opake body be two feet, while its distance from the flame of the candle is only one foot, then the light given out by the gas is four times as great as that of the candle.

The light given by the combustion of a jet of Glasgow gas, issuing from an orifice of 1-30th of an inch in diameter, and four inches in height, was as follows:—

1. On the north side of the river = 2.68 candles.
2. On the south side of the river = 1.77 "

This method of measuring the quantity of light appears, at first sight, very simple, but I found on trial that it was attended with so many sources of error, that I was afraid to depend upon it; fortunately there is another method of much easier execution, which I found much more satisfactory.

The quantity of light given out during the combustion of coal gas is very nearly proportional to its specific gravity; the heavier a gas is the slower does it issue from an orifice of a given diameter, when propelled by a given force. I measured the time which a cubic foot of each gas took to issue from an orifice of 1-30th of an inch, when propelled by a force such as to form a jet of flame, when lighted, of four inches in length, and I considered the goodness of the gas as proportional to this time: the result was as follows:—

1. Glasgow gas, north,	70′	18″
2. " south,	60	9
3. Skaterigg, . .	84	10
4. Lesmahagow, . .	101	10
5. Monkland, . .	101	

Certainly, in a commercial point of view, the value of the gas (the price per cubic foot being the same in all,) is exactly proportional to the time that it takes to burn, because the consumption in a given time depends upon that time.

If, therefore, a thousand cubic feet of gas be charged 8*s.* on both sides of the river, it is clear that the consumers on the south side pay at the rate of 9*s.* 4*d.* per cubic foot, because they consume 7000 cubic feet in the same time that those on the north side consume 6000.

If Glasgow gas, Skaterigg gas, and Lesmahagow gas are each charged at 8*s.* per 1000 cubic feet, the price paid by the consumers will be—

	s.	*d.*
1000 feet of Lesmahagow gas, . .	8	0

		s.	d.
1000 feet of Skaterigg gas,	. .	9	4¼
" Glasgow gas,	. . .	11	6½
" " south side river,		13	5¾

Lond., Edin., and Dub. Philos. Mag.

Summary of Experiments made with Screw Propeller and Rotary Engines fitted to Mr. Beale's trial boat, the "Pigmy Giant." By E. W. BAKER, *late Engineer of the Prince of Wales.*

The "Pigmy Giant" was built of iron by Messrs. Ditchburn and Mare, of Blackwall; she is 38 feet long, and of 8 feet 6 inches beam; 4 feet deep; her draught of water at midship 2 feet; midship section immersed = 9 square feet; she drops at the stern when going well about 12 inches, and is built to draw one foot more at the stern than at the head. The boat was originally intended for government service, and is built from the lines of a man-of-war's pinnace. The engines and boilers used in the experiments, afterwards detailed, are the same as those described in No. 1056, of this journal. The furnace is urged by a fan. The calculations of the power of the engine contained in the table, a vacuum has been added equal to a column of mercury of 20 inches, and the speed of the vessel through the water is the mean of various experiments. The weight of the valve and lever, together with Salter's spring balance, (which will amply allow for friction and steam cooling in pipes, &c.,) are not taken into account. In the column showing the cubic feet of water pumped into the boiler, the contents of the plunger are taken as being equal to 11.6 cubic inches, and one-third is deducted from the gross amount for leakage, &c.

From the following table it will be perceived that this little vessel requires an extraordinary degree of pressure to acquire any thing like velocity, and although no correct account of her consumption of fuel has been kept, I can state from personal observation, that when exceeding a speed of 9½, her consumption of *best oven coke* is nearly one cwt. per hour.

The propeller with which the experiments were made, was constructed by Mr. Joshua Taylor Beale, in imitation of Blaxland's, and is thus described by him in a paper originally intended for insertion in this journal; "Propeller is composed of four arms, and 4 segments of a screw, forming part of a four-threaded screw; its diameter 2 feet 1½ inches, and 4 feet pitch; segments equal half radius surface of each ONE-FIFTH OF THREE QUARTERS of a disk the diameter of the propeller; the arms may be round, or square; the propelling surface = two-ninths of midship section of boat; midship section of boat = 9 square feet."

Mr. J. B. Beale has discovered that *one-fifth of three quarters*, or in other words, *three-twentieths*, of a disk containing 510.7 square inches, will only contain 288, (this being the number of square inches

in two-ninths of 9 square feet,) instead of 306, the number usually assigned to it by other mathematicians. I must confess I do not understand this; perhaps Mr. Beale will explain.

Experiments with the "Pigmy Giant."

Pressure in pounds on the square inch in engine.	Strokes of the pump per minute.	Water pumped in the boiler in cubic feet per hour.	Number of revolutions of the engine.	Speed of the piston in feet per minute.	Calculated horse power.	Number of revolutions of the propeller.	Calculated speed of the propellers.	Speed of the boat through water in miles per hour.	Slip in miles per hour.
12	22	5.92	68.75	251.8	2 39	90.15	4.09	3.82	.27
14	26	7.0	81.25	297.78	3.08	106.65	4.84	4.51	.33
16	30	8 08	93.75	343.59	3.85	123.05	5.59	5.22	.37
18	34	9.16	106.25	389.40	4.70	139.45	6.33	5.91	.42
20	37	9.96	115.62	423.74	5.51	151.85	6.90	6.42	.48
22	38	10.24	118.75	435.21	6.01	155.85	7.08	6.54	.54
24	40	10.78	125.	458.12	6.72	164.05	7.45	6.85	.60
26	42	11.32	131.25	481.03	7.47	172.25	7.82	7.18	.64
28	44	11.86	137.50	503.93	8.26	180.45	8.20	7.54	.66
30	45	12.12	140.62	514.62	8.88	184.55	8.38	7.69	.69
32	47	12.66	146.87	537.52	9.74	192.75	8.76	8.2	.74
34	48	12.94	150.	548.91	10.42	196.85	8.94	8.31	.81
36	50	13.46	156.25	572.65	11.37	205.05	9.32	8.42	.90
38	52	14.02	162.50	595.56	12.34	213.25	9.69	8.70	.99
40	53	14.28	165.62	606.99	13.10	217.35	9.87	8.84	1.03
42	55	14.82	171.87	629.90	14.14	225.55	10.25	9.14	1.11
44	56	15.10	175.	641.37	14.92	229.65	10.43	9.22	1.20
46	57	15.36	178.12	652.80	15.78	233.75	10.62	9.28	1.34
48	58	15.64	181.25	664.28	16.63	237.85	10.81	9.44	1.37
50	59	15.90	184.37	675.71	17.50	241.95	10.94	9.52	1.42
52	60	16.18	187.50	687.18	18.39	246.05	11.18	9.54	1.74
54	61	16.14	190.62	698.62	19.33	250.15	11.37	9.62	1.75
56	62	16.70	193.75	710.09	20.23	254.25	11.55	9.74	1.81
58	64	17.24	200.	733.	21.52	262.45	11.92	9.81	2.11
60	65	17.52	203.12	744.43	22.5	266.55	12.36	9.96	2.40

The table, though not so perfect as could be wished, will enable the reader to form an opinion of this class of rotary engines, as it gives the *rotary* horse power requisite to propel 9 square feet of surface at a certain velocity. By comparing the results in this table with others obtained by the ordinary reciprocating engine, we shall have data to estimate which class of engine gives out the greatest effect.

It may not be out of place to add, that with a propeller constructed by Mr. Blaxland for trial in this boat, a speed of 10.5 was realized, which was the greatest ever attained by the *Pigmy Giant*. The same propeller divested of two of its blades, and containing less propelling surface than *half* of "*one-fifth of three-quarters* of a disk the diameter of the propeller," attained a speed of upwards of 10 miles per hour. A propeller of the same diameter, and with flat plates, when tried in this vessel, once reached a velocity of 6 miles per hour.

Lond. Mechanics' Mag.

Extraordinary Hydraulic Performance at Woolwich Dock-Yard.

A most interesting exhibition of hydraulic prowess recently took place in her majesty's dock-yard at Woolwich, where there is a floating caisson of large dimensions, from which it is occasionally necessary to remove the water. This has hitherto been accomplished by means of a pair of ten-inch pumps, fitted up in the best possible manner by an eminent engineering firm in London. These pumps have been worked by a party of thirty-two convicts, in two gangs of sixteen each, relieving each other at intervals of ten minutes, by which means the water has been pumped out in three hours and a half, the men at the end of that time being much distressed by their continued exertions. Mr. Walker (of Crooked-lane, King William street,) having offered to raise the required quantity of water *in half the time*, with *half the number of hands*, by means of his newly invented pump of which we gave an account in volume xl, page 307*, his proposal was made known to the Board of Admiralty, who immediately called upon Mr. Walker to fulfil his promise. Mr. Walker accordingly fitted up a pair of twelve-inch pumps worked by a rotary motion, which were completed and tried on the 20th of September last, under the superintendence of Captain Dennison, R.E., in the presence of Lord Adolphus Fitzclarence, Sir Francis Collier, Mr. Oliver Lang, and the principal authorities of the dock-yard, who seemed to take a lively interest in the experiment, as the speedy emptying of the caisson is to them a matter of great moment. The new pumps were manned by fourteen convicts (the same formerly employed in this work,) in two gangs of seven each, relieving each other at intervals of fifteen minutes. *In one hour and fourteen minutes* the required task was accomplished, the men being in no way fatigued! The quantity of water raised was about 3350 cubic feet, or 95 tons, lifted 13 feet high! The result of this trial created great astonishment among all present; Mr. Walker was warmly congratulated on having more than fulfilled his promise, and a full report of the trial was duly made to the Board.

By placing a second pair of Mr. Walker's improved pumps in the caisson, it may, in case of emergency, be emptied in half an hour by 28 hands, although with the former pumps 32 men could not accomplish that task in less than three hours and a half. It is always very desirable to have the power of quickly emptying the caisson, but under certain circumstances, in the event of fire, for instance, it is of the utmost importance to be able to do so.

Ibid.

Barometer Pump.

Colonel Everest also described an instrument called a barometer pump, for filling barometer tubes *in vacuo*. This was a single acting air-pump, so arranged as to exhaust the air from the tube to be filled,

* See Journal of the Franklin Institute vol. iv, 3rd series, page 109.

while a capillary tube, dipping into a reservoir of mercury, and curved at the end next the tube, dropped the mercury into the tube as it rose above the bend, (after the exhaustion had been carried as far as possible,) by dipping a glass rod into the reservoir. The mercury as it comes into the tube is heated to a temperature sufficient to boil it, and it is desiccated by a bottle of strong sulphuric acid, which is made to communicate with the canal into which the tube to be filled, and the capillary filling tube are luted. Colonel Everest mentioned that the best material for the valves of an air-pump was the swimming bladder of a fish.—*(Proc. Brit. Assoc.)*

Lond. Athenæum.

Report on a Hydrogen Furnace for Vitrification, and other applications of Heat in the Laboratory. By the Rev. W. V. Harcourt.

At the request of the British Association Mr. Harcourt had undertaken, some years since, to make experiments on vitrification. Dr. Faraday, in his experiments on glass, had the greatest difficulty in procuring perfectly homogeneous masses, arising, in most cases, from the almost impossibility of procuring a regulated heat in the ordinary furnaces. Mr. Harcourt, impressed with the advantages which might be gained for optical purposes, by procuring glasses formed by other salts and bases, instituted some experiments with a view of ascertaining this point. It was considered, that if a tribasic phosphate formed a glass, and the bibasic phosphate formed a glass, we should have, in all probability, glasses having different optical properties. Finding difficulty in proceeding with these experiments, at the heat given by ordinary furnaces, and the risk to which the platina crucibles were exposed, he was induced to try the effects of hydrogen burning in common air. Dr. Dalton was consulted on the construction of the first hydrogen furnaces, and he suggested the difficulty which was found to arise in practice—that hydrogen gas burning, through small orifices, with great pressure, would blow itself out. This difficulty was, however, overcome in the management of the apparatus brought before the Section. This apparatus consisted of an iron tube, in which the gas was generated by the addition of 15 ounces of zinc to three-quarters of a pint of oil of vitriol, and ten pints and a half of water. The gas produced was found to be in ten minutes under a pressure of 21 atmospheres, in sixteen minutes and a half under a pressure of 25 atmospheres, and in eighteen minutes under a pressure of 26 atmospheres. The gas was conducted into another cylinder, and from thence to the jets, over which was suspended a platina crucible. The gas being ignited at these jets, maintained, with the above charge, the platina crucible at a white heat for twenty minutes. Gems had been fused by the heat thus generated. Several kinds of jets were used, as it might be necessary to surround the crucible with heat, or only to apply the heat to the bottom of it. Experiments with this apparatus have been made upon the phosphates of antimony, zinc, barytes, and cadmium: the results have not been, however, quite satisfactory. In some the striæ inter-

fered with the transparency of the glass formed; and in the case of the monobasic phosphate of zinc, it was found that, to whatever heat the compound may have been exposed, the glass, thus formed, was deliquescent. The reading of this report was accompanied by some experiments with the hydrogen furnace in question, for the purpose of showing the intense heat which could be produced.

Dr. Faraday bore testimony to the advantages of this arrangement. He had found in all his experiments on glass, in which the elements were chemically combined, that crystalization took place. He regarded all common glass as examples of solution, rather than of chemical combination. Borate of lead, and sillicate of lead, if fused in small quantities, so that they cooled quickly, were transparent, but if fused in masses, which required a longer time, they were in a crystalline condition.—Mr. Harcourt remarked, that in the monobasic phosphate of zinc, which was transparent when vitrified, the quantity of acid was probably exceedingly small, but this glass was striated.—Dr. Faraday said, that some of the purest specimens of American ice show similar striæ, although it was in a state of exceeding purity, yielding the purest of all water when liquified.—Some remarks were then made by Mr. Pearsall, on the action of hydrogen on platina. An experiment was named by Mr. Harcourt, in which a platina tube was destroyed by an attempt to fuse ultra-marine in it.—Prof. Liebig stated, that platina was soon fused if exposed to a charcoal fire, from the action of the silicon contained in the charcoal.—*(Ib.)*

Ibid.

Contributions to Actino-Chemistry.—On the Amphitype, a new Photographic Process. By Sir J. Herschell.

At the end of my paper "On the Action of the Solar Spectrum on Vegetable Colors," communicated to the Royal Society, in 1842, a process is alluded to (in Art. 230,) by which positive pictures are obtained, having a perfect resemblance to impressions of engravings taken with common printers' ink. I had hoped speedily to have perfected this process so far as to have reduced it to a definite statement of manipulations, which would insure success. But, capricious as photographic processes notoriously are, this has proved so beyond even the ordinary measure of such caprice; and, having of late been able to give little or no time to this pursuit, I have thought it preferable to describe the process in a general way, and in a form in which I have found it frequently, and sometimes eminently successful; not so much for the sake of its results, which yet are not wanting in interest, or beauty, as for the curious and very complicated photographic habitudes of iron, mercury, and lead, which are concerned in their production,—rather, in short, as a contribution to the newly created science of *actino-chemistry*, than to the photographic art. Paper proper for producing an amphitype picture may be prepared either with the ferro-tartrate, or the ferro-citrate, of the protoxide, or the peroxide, of mercury, or of the protoxide of lead, by using creams of

these salts, or by successive applications of the nitrates of the respective oxides, singly, or in mixture, to the paper, alternating with solutions of the ammonio-tartrate, or ammonio-citrate, of iron,* the latter solutions being last applied, and in more or less excess. I purposely avoid stating proportions, as I have not yet been able to fix upon any which certainly succeed. Paper so prepared and dried takes a negative picture, in a time varying from half an hour to five or six hours, according to the intensity of the light; and the impression produced varies in apparent force from a faint and hardly perceptible picture, to one of the highest conceivable fullness and richness both of tint and detail, the color in this case being a superb velvety brown. This extreme richness of effect is not produced except lead be present, either in the ingredients used, or *in the paper itself.* It is not, as I originally supposed, due to the presence of free tartaric acid. The pictures in this state are not permanent. They fade in the dark, though with very different degrees of rapidity, some (especially if free tartaric, or citric, acid be present,) in a few days, while others remain for weeks unimpaired, and require whole years for their total obliteration; but though entirely faded out in appearance, the picture is only rendered dormant, and may be restored, changing its character from negative to positive, and its color from brown to black, (in the shadows,) by the following process:—

A bath being prepared by pouring a small quantity of solution of pernitrate of mercury into a large quantity of water, and letting the sub-nitrated precipitate subside, the picture must be immersed in it, (carefully and repeatedly clearing off all air bubbles,) and allowed to remain till the picture, (if anywhere visible,) is entirely destroyed, or if faded, till it is judged sufficient from previous experience; a term which is often marked by the appearance of a feeble positive picture, of a bright yellow hue, on the pale yellow ground of the paper. A long time (several weeks) is often required for this, but heat accelerates the action, and it is often complete in a few hours. In this state the picture is to be very thoroughly rinsed and soaked in pure warm water, and then dried. It is then to be well ironed with a smooth iron, heated so as barely not to injure the paper, placing it, for better security against scorching, between smooth clean papers. If then the process have been successful, a perfectly black, positive picture is at once developed. At first it most commonly happens that the whole picture is sooty, or dingy, to such a degree that it is condemned as spoiled, but on keeping it between the leaves of a book, especially in a moist atmosphere, by extremely slow degrees this dinginess disappears, and the picture disengages itself with continually increasing sharpness and clearness, and acquires the exact effect of a copper plate engraving on a paper more or less tinted with pale yellow. I ought to observe, that the best and most uniform specimens which I have procured have been on paper previously washed with certain preparations of uric acid, which is a very remarkable and powerful photographic element. The intensity of the original negative picture

* So commonly called, and sold as such, but as I am disposed to regard their composition, their chemical names would be ferro-tartrate and ferro-citrate of ammonia.

is no criterion of what may be expected in the positive. It is from the production, by one and the same action of the light, of either a positive, or a negative, picture, according to the subsequent manipulations, that I have designated the process, thus generally sketched out, by the term *amphitype*,—a name suggested by Mr. Talbot, to whom I communicated this singular result; and to this process, or class of processes, (which I cannot doubt when pursued will lead to some very beautiful results,) I propose to restrict the name in question, though it applies even more appropriately to the following exceedingly curious and remarkable one, in which silver is concerned. At the last meeting I announced a mode of producing, by means of a solution of silver, in conjunction with ferro-tartaric acid, a dormant picture brought out into a forcible negative impression by the breath, or moist air. The solution then described, and which had, at that time, been prepared some weeks, I may here incidentally remark, has retained its limpidity and photographic properties quite unimpaired during the whole year since elapsed, and is now as sensitive as ever,—a property of no small value. Now, when a picture (for example, an impression from an engraving,) is taken on paper washed with this solution, it shows no sign of a picture on its back, whether that on its face be developed, or not; but if, while the actinic influence is still fresh upon the face, (*i. e.* as soon as it is removed from the light,) ***the back*** be exposed for a very few seconds to the sunshine, and then removed to a gloomy place, a *positive picture, the exact complement of the negative one on the other side*, though wanting, of course, in sharpness if the paper be thick, *slowly and gradually makes its appearance* there, and in half an hour, or an hour, acquires a considerable intensity. I ought to mention that the "ferro-tartaric acid" in question, is prepared by precipitating the ferro-tartrate of ammonia (ammonia-tartrate of iron,) by acetate of lead, and decomposing the precipitate by dilute sulphuric acid.

P. S.—When lead is used in the preparation of amphitype paper, the parts on which the light has acted are found to be in a very high degree *rendered water-pooof.—(Ib.)*

Ibid.

Workshop Micrometer.

Mr. Whitworth then exhibited an instrument for measuring bodies to a very minute degree of accuracy. It consisted of a strong frame of cast-iron, at the opposite extremities of which were two highly finished steel cylinders, which traversed longitudinally by the action of screws one-twentieth of an inch in the thread; these screws were worked by two wheels, placed at opposite extremities of the frame, the larger of which had its circumference divided into five hundred equal parts; the ends of the cylinders, at the places were they approached each other, were reduced to about a quarter of an inch, and their hemispherical ends were highly polished. To measure with this instrument, the large circle was brought to its zero, and the body

to be measured being placed between the cylinders, the small circle was turned until the two cylinders touched the opposite sides of the body, which being removed, and the large circle turned until the ends of the two cylinders were brought to touch the turns and parts of a turn required for this, gave the breadth of the body which had been interposed to the ten-thousandth part of an inch, and since the one-tenth of one of the divisions could be readily estimated, the size of the body could be thus estimated easily to the one-hundredth-thousandth part of an inch. Mr. Whitworth stated, that in the accuracy required in modern workshops, in fitting the parts of tools and machines, the two-foot rule heretofore in use is not, by any means, accurate enough; his object was to furnish ordinary mechanics with an instrument which, while it afforded very accurate indications, was yet not very liable to be deranged by the rough handling of the workshop; and he conceived this instrument secured those advantages. It surprised himself to find how very minute a portion of space could be by it, as it were, felt. By it the difference of the diameters of two hairs could be rendered quite palpable.—*(Ib.)* Ibid.

Description of an Air-Duct to be used in Glass Furnaces, for the Prevention of Smoke. By Z. M. Greenhow.

Smoke, it is assumed, must be prevented by the supply, under proper conditions, of additional quantities of oxygen gas. Though this intention has been successfully carried out in steam engine and other furnaces, no attempt has been successful to prevent the annoyance occasioned by glass furnaces. One of Mr. Greenhow's models represented the reverberatory furnace used in the manufacture of crown glass. In this kind of furnace the smoke and products of combustion escape through the openings in the sides, which give the workmen access to the pots of glass, and are unprovided with flues. To provide the necessary supply of fresh air, Mr. Greenhow proposes a perpendicular air duct (made of the same refractory clay of which the glass pots are constructed,) rising through the middle of the fire, and supported by the stone arch on which the bars rest. This air-duct rises to the height of five feet within the furnace, is one foot in diameter, and distributes, through numerous apertures, any quantity of air that may be required for the completion of the combustion of the fuel; and from its situation in the centre of the furnace, it must soon acquire and communicate a high degree of temperature to the air it transmits. Mr. Greenhow showed a second model of a steam engine furnace with a horizontal air-duct placed anterior to the bridge which it crowns and overlaps. At this situation heated air is distributed through small apertures, so as to mingle with the burning gases, and insure their more complete combustion.—*(Ib.)*

Ibid.

On the Alteration that takes place in Iron by being exposed to long continued Vibration. By Mr. W. Lucas.

At Cork, this subject was again brought forward, and certain spe-

cimens of iron exhibited, in order to show the effects produced upon the iron by being exposed to a certain degree of concussion, or vibration, during the process of swaging, and again restored to its original state by being annealed, in accordance with the results detailed by Mr. Nasmyth, at Manchester, in 1842; in addition to these, also were exhibited specimens of portions of the same iron that had been exposed to the concussion of a large tilt hammer, working at the rate of about 350 strokes per minute, which occasioned the bars of iron to break short off at the point of bearing in the course of twenty-four hours; there was also shown a portion of one of the hammer shafts, the texture of which had evidently been altered, probably by the long continued and repeated concussions to which it had been exposed, for instead of breaking with the peculiar splintery fracture common to wood, it broke with a peculiar short fracture, and this, I am informed, is a common occurrence. In continuance of these experiments upon the effects of concussion, or vibration, Mr. Lucas laid before the Section the results of some further experiments.—*(Ib.)*

Ibid.

Iron Steamboats.

"The Wonder," an iron steamboat built by Messrs. Ditchburn and Mair, the successful builders of iron vessels, for running between Southampton and Havre, made a trial trip down the river Thames on the 27th of September last; her length is 160 feet, breadth of beam 22 feet, depth of hold 12 feet 9 inches, draught when light 5 feet 6 inches, when loaded 6 feet 6 inches. She is fitted with three engines on the atmospheric principle, by Messrs. Seaward and Capel, of the Canal Iron Works, Blackwall; each engine has an open topped cylinder 53 inches diameter, with a 3 feet 6 inches stroke, they work on the direct action principle; the lower end of the piston rods move on a joint attached to the top of the piston, and the other end is connected to the crank of the paddle-wheel shaft, the 3 cranks being placed at different angles, so that when one piston is at the top of the cylinder, another is at the bottom, and the third about the middle; the three cylinders exhaust their steam into one condenser, with one air-pump. The engines during the trial made 38 and 39 strokes per minute, the paddle-wheels are 19 feet diameter to the extremity of the float boards, and are on the self-feathering principle, being a modification of Morgan's paddle-wheel; the nominal power of the three engines, at a velocity of 220 feet per minute, is equal to 150 horses, but the real effective power is nearer double, as proved by the great velocity of the vessel. She ran the mile distance in 4 minutes 17 seconds against tide, being a velocity equal to 14 miles per hour, the tide running at the time about 2½ miles per hour. The boiler is of the tubular principle, with five furnaces, and is only 7 feet 6 inches long; it is furnished with a brine apparatus for constantly drawing off a certain quantity of water, this water is pressed by the force of the steam through a pipe dipping down to near the bottom of the boiler, and coming out in the front near the top, where it is furnished with

a cock to regulate the emission of the water, this pipe passes along the front of the boiler, then along side of the engine room to a cistern in which the water runs, and is allowed to overflow to the outside of the vessel. The water for supplying the boiler is taken from the hot well, and forced by the feed pump through a pipe which passes backwards and forwards two or three times in the brine cistern just described, and thence into the boiler; by this process the boilers are supplied with water nearly at a boiling temperature. There are several other ingenious contrivances adopted by Messrs. Seaward and Capel for working the valves, &c. Civ. Eng. & Arc. Journ.

Her Majesty's Steamship Rattler with Smith's Screw Propeller.

This fine steam frigate, after having made a great variety of experiments with the different propellers that have been projected by Mr. Smith, Mr. Woodcroft, Mr. Blaxland, Mr. Steinman, Mr. Sunderland, and other persons, in order to ascertain their comparative merits, lately made her final trial in the river. The screw that has been found to produce the highest rate of speed with the smallest consumption of power, is that of Mr. F. T. Smith, known as the inventor and adapter of the Archimedean screw. The Admiralty have in consequence determined to send the Rattler to sea, fitted with a propeller in accordance with the suggestions of that gentleman. The last trial was made partly with the view of ascertaining the precise rate of the ship in steaming in smooth water with Mr. F. T. Smith's propeller, and partly to determine its effect as compared with what had been done with other propellers that have been recommended to the notice of the Admiralty. On this occasion the average of twelve trials at the measured distance in Long-reach showed a speed of 9.9 knots, or 11½ statute miles, an hour, which rate of speed, considered in comparison with the small amount of power, viz., 200 h. p., the amount of power of the engine of the Rattler, in relation with her tonnage, 888 tons, ranks her performance higher in the history of steam navigation than the performance of any vessel of her class, either in the service of her majesty, or in the commercial steam navy of the empire. It should be mentioned that the Rattler was built in every respect as a sister ship to her majesty's steam ship the Prometheus, with this difference, that the Prometheus has paddle-wheels. The Prometheus, on her trial at the measured distance, reached only to the rate of 8¾ knots an hour. The Rattler has already got her masts on board; she is rigged with a foremast like a frigate, or sloop, her middle and mizen masts are rigged as schooner masts, her gun carriages are also on board, and she is ordered to be equipped for sea as speedily as possible; and in consequence of the complete success which has attended the application of the screws to her, several others, we believe six, iron ships of a large class are forthwith to be constructed on the same principle. The trials were made under the superintendence of Mr. Lloyd, chief engineer of Woolwich dockyard, and Captain Smith, R. N., of the royal dockyard.

London Times.

On Crystals in the Cavities of Topaz, which are dissolved by heat, and re-crystalized on Cooling. By Sir DAVID BREWSTER.

Sir David gave a brief notice of the discovery which he had made, about twenty years ago, of two new fluids in the crystalized cavities of *topaz*, and other minerals. One of these fluids is very volatile, and so expansible, that it expands twenty times as much as water with the same increase of temperature. When the vacuities in the cavity which it occupies are large, it passes into vapor, and in these different states he had succeeded in determining its refractive power, by measuring the angles at five feet. Total reflection takes place at the common surface of the fluid of the topaz. The other fluid is of a denser kind, and occupies the angles and narrow necks of cavities. The cavities, however, in which the soluble crystals were contained, are of a different kind. They (viz. the cavities,) were imperfectly crystalized, and thus they exist in specimens of topaz which contain the cavities with the two new fluids; they contain none of the volatile and expansible fluid, which is doubtless a condensed gas. The crystals which occupy them are flat, and finely crystalized rhomboids. When heat is applied, they become rounded at their angles and edges, and soon disappear. After the topaz has cooled, they again appear, at first like a speck, and then recrystalize gradually, sometimes in their original place, but often in other parts of the cavity, their place being determined by the mode in which the cooling is applied. We understand that Prof. Liebig, who regards these fluids and crystals as peculiarly interesting, has made arrangements to investigate their nature, when taken out of their cavities by Sir David Brewster,—an operation of extreme difficulty, owing to the small size of the cavities which contain them, and the rapid disappearance of the volatile fluid, which rises into a drop, and contracts into a flat disk, as if it were endued with vitality, finally vanishing and leaving a sediment behind it, which, when breathed upon, again becomes fluid.—*Pro. Brit. Ass.*

Lond. Athenæum.

Heath's Cast-Steel.

Before the introduction of Mr. Heath's process, which consists in adding carburet of manganese to the melting pot, all steel which was to be worked into a fine edge was made of iron procured from one mine only, that of Dannemora, in Sweden. It was consigned to a house at Hull, at a cost of 38*l.* per ton, in quantities not exceeding 1100 tons per annum, and marked L in a hoop. The price limited its use; but by means of this patent the inferior sorts of iron, as those at 15*l.* per ton, may be made available. Steel is made by it which has all the beauty of cast-steel, and all the welding advantages of shear steel. In the manufacture of table knives its advantages have been manifest. Formerly these articles were made by tilting, or rolling, square bars of steel into the necessary shape, thus making blade, shoulder, and tang in one piece; so difficult was this process, that two wasters in a dozen knives were always thrown aside, and workmen's wages were double. Now, the steel blade, made by this process is welded with the iron tang. Lond. Min. Journ.

Variation of the Boiling Point of Water in Vessels of different Materials.

M. Marcet (Ann. de Chim. et de Phys. v. 449,) has made a series of accurate experiments upon the variations of the boiling point of water, dependent upon the nature of the vessel in which it is made to boil. The following are the results of his researches:—1st. The boiling point of water in glass vessels is from 100.3° to 102° cent., varying with certain circumstances, more especially with the different kinds of glass. In these cases the temperature of the vapor of water is constantly the same, and some hundredths of a degree lower than when water is boiled in metallic vessels. 2d. Whatever the nature of the vessel in which the ebullition takes place, the temperature of the vapor is always lower than that of the water from which it is generated. This difference in the case of glass vessels is about 1.06° cent.; in metallic vessels 0.15° to 0.20° cent. There is only one exception to this rule, which is, when the interior of the vessel, whether of glass, or metal, is covered with a thin coat of sulphur, or gum lac, or any other substance which exercises a repulsion of water; the boiling water and the vapor then have the same temperature. 3d. Contrary to the opinion generally admitted, it is not in metallic vessels that the boiling point is lowest under an increased pressure, but in glass vessels covered internally with a thin coat of the substances mentioned above. 4th. In glass vessels having the internal surface perfectly smooth, and free from foreign matter, water and alcohol can be heated several degrees above their boiling point before they enter into ebullition. Water can thus be heated to 105° cent. If the experiment does not succeed, it is because there is foreign matter adhering to the glass. The experiment may be performed successfully with a new vessel, by first heating sulphuric acid in it to 150° cent., then washing it out with pure water.

Lond. Journ. Arts & Sciences.

Apparatus to enable the Blind to Read and Write.

The Reverend W. Taylor gave an explanation of an apparatus, invented by Mr. Littledale, of York, by which the blind can write and read. The following is a description of the instrument, as given in the local papers:—"Into a case, probably a yard long, and three or four inches square, is fitted a slide, something like one section of a letter-rack used in printing offices for depositing the type when not in use. This slide is adapted to any alphabet, or to arbitrary characters. At one end of the case there is a hammer, under which the paper is placed, and as the letters are brought up successively, by the application of an ingenious contrivance at the opposite end of the case, the hammer is raised, and by its fall they are impressed, or rather embossed, upon the paper, so that blind persons may distinguish them by the touch. When the first letter of a word is printed, the hammer is raised, and that causes the letter to move away, and,

at the same time, a space on the paper for the next letter is produced. The blank between each letter, or word, may be increased by raising the hammer twice, or thrice, instead of once. The successive letters are brought up to the hammer, by the means before alluded to. There is also a prepared paper (black,) which may be put over the white paper at discretion, the object of which is to enable persons who have their sight to read the printing better, the force of the hammer causing the black paper to 'set off.' At the hammer end of the case a piece of cloth is attached, to place between the hammer and the type, so that the letter may not be bruised. The type in the slide was made of wood, but to metallic letters the instrument would be equally applicable.—*Proc. Brit. Assoc.*

Lond. Athenæum.

Meteorological Observations.

The President remarked, that meteorological observations required the atmosphere to be in a very peculiar state, in order to insure accurate definition. He believed it was Struve who first remarked, that whenever the temperature of the night sunk much below the mean of the preceding twenty-four hours, no accurate definition of objects was to be expected. Dr. Robinson said the hygrometrical state of the air was of much consequence for astronomical observations; he found that it required to be very near the point of saturation, as a difference between the wet and dry bulb thermometers of more than a degree, or two, precluded all accurate definition, the brighter stars having then a tendency to throw out scintillating lines; and it was only in the moist state of the air that they appeared distinct in themselves, although surrounded by faint colored rays.—Rev. Dr. Scoresby remarked how one branch of physical research bore upon other branches. He believed that the hour at which Lord Rosse found that he could best test the accuracy of figure given to his splendid reflectors, was that which Sir David Brewster had ascertained to be the time of mean temperature for the twenty-four hours.—Lord Rosse said, that the test being the formation of a distinct image of a watch dial placed at a considerable elevation, say 100 feet, above the tower, it was necessary, in order that there should be no tremor of the air, that the temperature within and outside the tower should be as nearly equal as possible, and that this was pretty much the time of the mean temperature of the day—about twenty minutes past nine in the morning.—*(Ibid.)*

Ibid.